

SOME BASIC CONCEPT OF CHEMISTRY (MOLE CONCEPT)

- The volume of a gas at 0°C and 760 mm pressure is 22.4 cc. The no. of molecules present in this volume is
 (1) $10^{-3} N_A$ (2) $10^{-4} N_A$
 (3) $10^{-5} N_A$ (4) $10^{-2} N_A$
- 100 mL of PH_3 when completely decomposed produces phosphorus and hydrogen. The change in volume of the gas is -

$$\text{PH}_3(\text{g}) \longrightarrow \text{P}(\text{s}) + \frac{3}{2} \text{H}_2(\text{g})$$

 (1) 50 mL increase (2) 500 mL decrease
 (3) 900 mL decrease (4) Does not changes
- The mass of a molecule of water :
 (1) $30 \times 10^{-24} \text{ kg}$ (2) $3 \times 10^{-26} \text{ kg}$
 (3) $1.5 \times 10^{-26} \text{ kg}$ (4) $2.5 \times 10^{-27} \text{ kg}$
- 19.7 kg of gold was recovered from a smuggler. How many atoms of gold were recovered ? (At. wt. of gold (Au) = 197)
 (1) 100 (2) 6.023×10^{23}
 (3) 6.023×10^{24} (4) 6.023×10^{25}
- Chlorine is prepared in the laboratory by treating manganese dioxide (MnO_2) with aqueous hydrochloric acid according to the reaction

$$4\text{HCl}(\text{aq}) + \text{MnO}_2(\text{s}) \longrightarrow 2\text{H}_2\text{O}(\ell) + \text{MnCl}_2(\text{aq}) + \text{Cl}_2(\text{g})$$

 How many gram of HCl react with 5.0 g of manganese dioxide ? (At. wt. of Mn = 55)
 (1) 2.12 g (2) 44.24 g
 (3) 8.4 g (4) 3.65 g
- An unknown amino acid has 0.032% sulphur by wt. If each molecule has one S atom only, 1 g. of amino acid has molecules :-
 (1) 6.02×10^{18} (2) 6.02×10^{19}
 (3) 6.02×10^{24} (4) 6.02×10^{23}
- 446 g of PbO , 46 g of NO_2 and 16 g of O_2 are allowed to react according to the equation :-

$$\text{PbO} + 2\text{NO}_2 + \frac{1}{2} \text{O}_2 \longrightarrow \text{Pb}(\text{NO}_3)_2$$

 The amount of $\text{Pb}(\text{NO}_3)_2$ that can be produced is (At. wt. of Pb = 207) :-
 (1) 331 g (2) 662 g
 (3) 165.5 g (4) 132.5 g
- 44g of a sample of organic compound on complete combustion gives 88g CO_2 and 36g of H_2O . The molecular formula of the compound may be :-
 (1) C_4H_6 (2) $\text{C}_2\text{H}_6\text{O}$
 (3) $\text{C}_2\text{H}_4\text{O}$ (4) $\text{C}_3\text{H}_6\text{O}$
- Volume at N.T.P. of 0.22 g of CO_2 is same as that of
 (1) 0.01 g of hydrogen
 (2) 0.085 g of NH_3
 (3) 320 mg of gaseous SO_2
 (4) All the above
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- Which of the following has maximum mass :-
 (1) 0.1 gram atom of carbon
 (2) 0.1 mol of ammonia
 (3) 6.02×10^{22} molecules of hydrogen
 (4) 1120 cc of carbon dioxide at STP
- What mass of NaCl would be decomposed by 98 g of H_2SO_4 if 120 g of NaHSO_4 and 27.5 g of HCl are produced in a reaction. Assuming that law of mass conservation is true:
 (1) 4.95 g (2) 49.5 g (3) 0.495 g (4) 495 g
- Equal mass of oxygen, hydrogen and methane are taken in a container in identical conditions. What is the ratio of their moles :-
 (1) 1 : 16 : 1 (2) 1 : 16 : 2
 (3) 8 : 1 : 8 (4) 16 : 1 : 8
- When 40 cc of slightly moist hydrogen chloride gas is mixed with 20 cc of ammonia gas the final volume; of gas left at the same temperature and pressure will be

$$\text{NH}_3(\text{g}) + \text{HCl}(\text{g}) \longrightarrow \text{NH}_4\text{Cl}(\text{s})$$

 (1) 20 cc (2) 40 cc
 (3) 60 cc (4) 100 cc
- Which of the following has greatest number of atoms :-
 (1) 1g of butane (C_4H_{10})
 (2) 1 g of nitrogen (N_2)
 (3) 1 g of silver (Ag)
 (4) 1 g of water (H_2O)

15. One atom of an element 'X' weighs 6.664×10^{-23} g. The number of gram atoms in 40 kg of it is
(1) 10 (2) 100 (3) 10000 (4) 1000
16. In the reaction, $4A + 2B + 3C \rightarrow A_4B_2C_3$, what will be the number of moles of product formed, starting from 1 mol of A, 0.6 mol of B and 0.72 mol of C :-
(1) 0.25 (2) 0.3 (3) 0.24 (4) 2.32
17. If $Ca_3(PO_4)_2$ and H_3PO_3 contain same number of 'P' atom then the ratio of oxygen atoms in these compounds respectively is :-
(1) 8/3 (2) 2/3 (3) 3 (4) 4/3
18. Calculate the number of oxygen atoms required to combine with 7g of N_2 to form N_2O_3 when 80% of N_2 is converted into N_2O_3 :-
(1) 2.3×10^{23} (2) 3.6×10^{23}
(3) 1.8×10^{21} (4) 5.4×10^{21}
19. Element X reacts with oxygen to produce a pure sample of X_2O_3 . In an experiment it is found that 1.00 g of X produces 1.16 g of X_2O_3 . Calculate the atomic weight of X :-
(1) 67 (2) 100.2 (3) 125 (4) 150
20. In a compound A containing carbon, hydrogen and oxygen, the % of hydrogen is one sixth that of carbon which is 1.5 times that of oxygen. What is the simplest formula for the compound:-
(1) $C_2H_4O_2$ (2) C_2H_4O
(3) C_2H_6O (4) CH_4O
21. 1 mole of Fe_2S_3 , 2 moles of H_2O and 3 moles of O_2 are allowed to react according to the equation
 $[2Fe_2S_3(s) + 6H_2O(l) + 3O_2(g) \rightarrow 4Fe(OH)_3(s) + 6S(s)]$
The number of moles of $Fe(OH)_3(s)$ that can be produced is :-
(1) 1.34 (2) 2 (3) 4 (4) 3
22. A gaseous alkane was burnt with oxygen. The volume of O_2 for complete combustion and that of CO_2 formed are in the ratio of 7 : 4. The molecular formula of alkane is :-
(1) CH_4 (2) C_2H_6 (3) C_3H_8 (4) C_4H_{10}
23. Two oxides of a metal contain 22.22% and 30% oxygen by mass respectively. If the formula of the first oxide is MO , then the formula of the second oxide is :-
(1) MO (2) MO_2 (3) M_2O_3 (4) M_2O
24. Caffeine has a molecular weight of 194. If it contains 29% by mass of nitrogen, number of atoms of nitrogen in one molecule of caffeine is :-
(1) 2 (2) 6 (3) 4 (4) 3
25. Sulphur trioxide is prepared by the following two reactions.
 $S_8(s) + 8O_2(g) \rightarrow 8SO_2(g)$
 $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$
How many grams of SO_3 are produced from 1 mol of S_8 ?
(1) 1280.0 (2) 640.0 (3) 960.0 (4) 320.0

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Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans	1	1	2	4	3	1	3	3	4	4	2	2	1	1	4
Que.	16	17	18	19	20	21	22	23	24	25					
Ans	3	4	2	4	2	1	2	3	3	2					

ATOMIC STRUCTURE

- Energy required for the process is :
 $\text{He}^+(g) \longrightarrow \text{He}^{+2}(g) + e^-$
 The ionisation energy for the H-atom in the ground state is $2.18 \times 10^{-18} \text{ J atom}^{-1}$
 (1) $9.12 \times 10^{-18} \text{ J}$ (2) $8.72 \times 10^{-18} \text{ J}$
 (3) $4.72 \times 10^{-20} \text{ J}$ (4) $7.82 \times 10^{-16} \text{ J}$
- The difference between n^{th} and $(n + 1)^{\text{th}}$ Bohr orbits' radii of H atom is equal to its $(n - 1)^{\text{th}}$ Bohr orbit's radius. The value of n is :-
 (1) 1 (2) 2 (3) 3 (4) 4
- When an electron of mass $6m$ and charge $6e$ moves with a velocity of $7v$ about the nuclear charge Ze in a circular orbit of radius ' r '. The potential energy of the electron will be :-
 (1) $-\frac{Ze^2}{r}$ (2) $+\frac{Ze^2}{r}$
 (3) $-\frac{6Ze^2}{r}$ (4) $-\frac{2\pi^2 me^4 Z^2}{n^2 h^2}$
- Be^{+3} and a proton are accelerated by the same potential, their de-Broglie wavelengths have the ratio :
 (Assume mass of proton = mass of neutron)
 (1) 1 : 2 (2) 1 : 4
 (3) 1 : 1 (4) 1 : $3\sqrt{3}$
- A single electron in an ion has ionisation energy equal to 217.6 eV. What is the total number of neutrons present in that ion is :-
 (1) 2 (2) 4 (3) 5 (4) 9
- The number of photons emitted in 10 hours by a 60 W sodium lamp ($\lambda = 5893 \text{ \AA}$) will be :-
 (1) 1.6×10^{24} (2) 3.2×10^{24}
 (3) 6.4×10^{24} (4) 8×10^{23}
- The distance between 3^{rd} and 2^{nd} orbit of hydrogen atom :-
 (1) $2.646 \times 10^{-8} \text{ cm}$ (2) $2.116 \times 10^{-8} \text{ cm}$
 (3) $1.058 \times 10^{-8} \text{ cm}$ (4) $0.529 \times 10^{-8} \text{ cm}$
- How fast is an electron moving if it has a wavelength equal to the distance it travels in one second ?
 (1) $\sqrt{\frac{h}{m}}$ (2) $\sqrt{\frac{m}{h}}$
 (3) $\sqrt{\frac{h}{P}}$ (4) $\sqrt{\frac{h}{2(KE)}}$
- Hydrogen atoms are excited to $n = 4$ state, in the spectrum of emitted radiation, number of lines in the ultraviolet and visible regions are respectively :-
 (1) 3, 1 (2) 1, 3 (3) 2, 3 (4) 3, 2
- Which orbital notation does not have spherical node :-
 (1) $n = 2, \ell = 0$ (2) $n = 3, \ell = 1$
 (3) $n = 3, \ell = 0$ (4) $n = 1, \ell = 0$
- The difference in angular momentum associated with the electron in two successive orbits of hydrogen atom is :-
 (1) $\frac{h}{\pi}$ (2) $\frac{h}{2\pi}$
 (3) $\frac{h}{2}$ (4) $(n-1) \frac{h}{2\pi}$
- If uncertainties in the measurement of position and momentum are equal, uncertainty in the measurement of velocity.
 (1) $\frac{1}{m} \sqrt{\frac{h}{\pi}}$ (2) $\frac{1}{2m} \sqrt{\frac{h}{\pi}}$
 (3) $\sqrt{\frac{h}{\pi}}$ (4) None of these
- Find out the number of waves made by a Bohr electron in one complete revolution in its fourth orbit.
 (1) 3 (2) 4 (3) 2 (4) 1

14. If a 1.00 g body is travelling along the x-axis at 100 cm s^{-1} within 1 cm s^{-1} , what is the theoretical uncertainty in its position (in meter)
 (1) 5.25×10^{-30} (2) 6×10^{-10}
 (3) 10×10^{-8} (4) 6.42×10^{-28}
15. The ratio of the energy of the electron in ground state of hydrogen to the electron in first excited state of Be^{3+} is :-
 (1) 1 : 4 (2) 1 : 8
 (3) 1 : 16 (4) 16 : 1
16. The amount of energy required to remove electron from a Li^{+2} ion in its ground state is how many times greater than the amount of energy needed to remove the electron from an H atom in its ground state ?
 (1) 9 (2) 6 (3) 4 (4) 5
17. What is the difference in wavelengths of the 4th and 5th lines of the Balmer series in the spectrum of atomic hydrogen :-
 (1) 131 Å (2) 520 Å
 (3) 390 Å (4) 262 Å
18. In a certain electronic transition in the hydrogen atom from an initial state (i) to a final state (f) the difference in the orbit radius ($r_i - r_f$) is seven times the Bohr radius. Identify the transition :-
 (1) $4 \rightarrow 1$ (2) $4 \rightarrow 2$
 (3) $4 \rightarrow 3$ (4) $3 \rightarrow 1$
19. A tennis ball weighing 0.91 kg and an electron travel with the same velocity of 10^2 m/sec . The ratio of their de-Broglie wavelengths will be :-
 (1) 1 : 10^{-26} (2) 10^{-26} : 1
 (3) 1 : 10^{-30} (4) 10^{-30} : 1
20. The circumference of the 4th Bohr orbit in hydrogen atom is 5.32 nm. The de Broglie wavelength of the electron revolving in this orbit is :-
 (1) 0.133 nm (2) 13.3 nm
 (3) 1.33 nm (4) 133 nm
21. A hydrogen atom in an excited state is ionised by the absorption of radiation with a photon energy of 1 eV. What is the minimum value of n for excited state of the atom :-
 (1) 1 (2) 2 (3) 3 (4) 4
22. Which of the following statements is correct :-
 (1) (n-1)d subshell has lower energy than ns subshell
 (2) (n-1)d subshell has higher energy than ns subshell
 (3) (n+1)d subshell has lower energy than nf subshell
 (4) nf subshell has lower energy than (n + 2) s subshell
23. Which of the following statements regarding an orbital is correct :-
 (1) An orbital is a definite trajectory around the nucleus in which electron can move
 (2) An orbital always has spherical trajectory
 (3) It is the region around the nucleus where there is 90% to 95% probability of finding all electrons in an atom
 (4) An orbital is characterised by the three distinct quantum numbers n, ℓ and m
24. Following transitions occurring in hydrogen atoms ($n_1 < n_2 < n_3$)
 $n_1 \text{ orbit} \xrightarrow{1} n_2 \text{ orbit}$
 $n_2 \text{ orbit} \xrightarrow{2} n_3 \text{ orbit}$
 $n_1 \text{ orbit} \xrightarrow{3} n_3 \text{ orbit}$
 Which of the following relation is not correct?
 (1) $\lambda_3 = \lambda_1 + \lambda_2$
 (2) $\frac{1}{\nu_3} = \frac{1}{\nu_1} + \frac{1}{\nu_2}$
 (3) $\nu_3 = \nu_1 + \nu_2$
 (4) $\Delta E_3 = \Delta E_1 + \Delta E_2$
25. In Cr atom, the number of electrons having $n + m = 3$ are :-
 (1) 5 (2) 6 (3) 7 (4) 8

26. Two particles A and B are in motion, wavelength related to particle A is 5×10^{-8} m. If the momentum of particle B is half of A then what will be the wavelength of B :-
 (1) 2.5×10^{-8} m (2) 1.25×10^{-8} m
 (3) 1×10^{-7} m (4) 1×10^{-8} m
27. The value of $(n_2 + n_1)$ and $(n_2^2 - n_1^2)$ for $\text{He}^{\oplus}$ ion in atomic spectrum are 4 and 8 respectively. The wavelength of emitted photon on transition of electron from n_2 to n_1 is :-
 (1) $\frac{32 R_H}{9}$ (2) $\frac{9 R_H}{32}$ (3) $\frac{9}{32 R_H}$ (4) $\frac{32}{9 R_H}$
28. If the ionization energy of He^+ is 19.6×10^{-18} J atom^{-1} , then calculate the energy of first stationary state of Li^{2+} .
 (1) -1.1×10^{-17} J/atom
 (2) -1.1×10^{-18} J/atom
 (3) -4.41×10^{-17} J/atom
 (4) -4.41×10^{-18} J/atom
29. What is the frequency of a photon emitted during a transition from $n = 4$ state to the $n = 2$ state in the hydrogen atom ?
 (1) 6.15×10^{11} Hz (2) 6.15×10^{14} Hz
 (3) 3.12×10^7 Hz (4) 1.23×10^9 Hz
30. A moving electron has 4.55×10^{-25} Joules of kinetic energy. Calculate its wavelength ($m_e = 9.1 \times 10^{-31}$ Kg)
 (1) 2.55×10^{-6} m
 (2) 3.57×10^{-5} m
 (3) 1.45×10^{-4} m
 (4) 7.25×10^{-7} m
31. With what velocity must an electron travel so that its momentum is equal to that of photon of wavelength of $\lambda = 5200 \text{ \AA}$?
 (1) 800 ms^{-1} (2) 1400 ms^{-1}
 (3) 400 ms^{-1} (4) 200 ms^{-1}
32. The angular momentum of an electron in a Bohr's orbit of H atom is $4.2178 \times 10^{-34} \text{ kg-m}^2/\text{sec}$. Calculate the wavelength of spectral line emitted when electron falls from this level to next lower level.
 (1) 1.8×10^{-4} cm
 (2) 2.8×10^{-5} cm
 (3) 4.6×10^{-4} cm
 (4) 2.2×10^{-6} cm

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ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	4	3	4	3	3	1	1	4	4	2	2	2	1	1
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	1	1	3	4	3	4	2	4	1	3	3	3	3	2	4
Que.	31	32													
Ans.	2	1													

CHEMICAL EQUILIBRIUM

1. For the reaction $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$
Initial moles are a b c
If α is the degree of dissociation and P is the total pressure, then the partial pressure of PCl_3 is :-

(1) $\frac{b + a\alpha}{a + b + c + a\alpha}$ P atm.

(2) $\frac{a + a\alpha}{a + b + c + a\alpha}$ P atm.

(3) $\frac{a(1 - \alpha)}{a + b + c + a\alpha}$ P atm.

(4) $\frac{a + b + c + a\alpha}{b + a\alpha}$ P atm.

2. When sulphur is heated at 800 K, there exists on equilibrium $\text{S}_8(\text{g}) \rightleftharpoons 4\text{S}_2(\text{g})$. The initial pressure of 1 atm. falls by 20% at equilibrium. Find the value of K_p for the referred reaction

- (1) 0.512 atm^3 (2) 2.50 atm^3
(3) 1.20 atm^3 (4) 3.24 atm^3

3. NaHCO_3 decomposes as :
 $2\text{NaHCO}_3(\text{s}) \rightleftharpoons \text{Na}_2\text{CO}_3(\text{s}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$
The equilibrium pressure is 1.04 atm. The K_p for the reaction is :

- (1) 0.2704 (2) 2.704 (3) 27.04 (4) 270.4

4. The equilibrium constant at a certain temp. for the reaction $\text{A}_2 + \text{B}_2 \rightleftharpoons 2\text{AB}$ is 2. Calculate the degree of dissociation of either A_2 or B_2 :

- (1) 0.2 (2) 0.5
(3) $\frac{1}{(1 + \sqrt{2})}$ (4) $\frac{\sqrt{2}}{(1 + \sqrt{2})}$

5. The equilibrium constant for the esterification reaction of acetic acid and ethyl alcohol at 100°C is 4. What percentage of alcohol has been esterified ?

- (1) 45% (2) 20% (3) 54% (4) 66%

6. In which of the following case the reaction is nearest to completion ?

- (1) $K_{\text{eq}} = 10^6$ (2) $K_{\text{eq}} = 10^2$
(3) $K_{\text{eq}} = 10^{-6}$ (4) $K_{\text{eq}} = 10^{-12}$

7. Reaction $\text{N}_2\text{O}_3 \rightleftharpoons \text{NO} + \text{NO}_2$ was studied by taking 2 mol L^{-1} of N_2O_3 initially. At equilibrium degree of dissociation of N_2O_3 was found to be 10%. What is the ratio of equilibrium concentration of $[\text{N}_2\text{O}_3]$, $[\text{NO}]$ and $[\text{NO}_2]$:

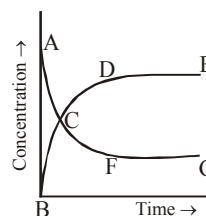
- (1) 19 : 1 : 1 (2) 9 : 1 : 1
(3) 1 : 1 : 9 (4) 18 : 1 : 1

8. The equilibrium constant for reaction $\text{H}_2(\text{g}) + \text{CO}_2(\text{g}) \rightleftharpoons \text{H}_2\text{O}(\text{g}) + \text{CO}(\text{g})$ is 1.8 at 1000°C . If one mole of H_2 and 1.0 mole of CO_2 are placed in a one litre flask. The final equilibrium concentration of CO at 1000°C will

be $(\sqrt{1.8} = 1.34)$:-

- (1) 0.573 M (2) 0.386 M
(3) 0.290 M (4) 0.688 M

9. $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$, $K_c = 4$. This reversible reaction is studied graphically as shown in the given figure. Select the correct statements out of I, II and III

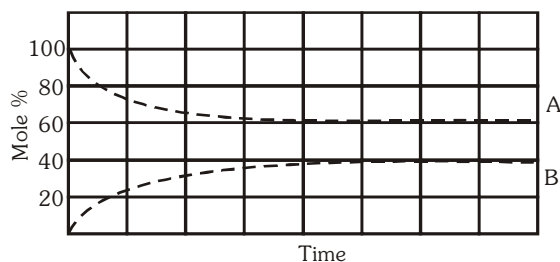


- I. Reaction quotient has maximum value at point A
II. Reaction proceeds left to right at a point when $[\text{N}_2\text{O}_4] = [\text{NO}_2] = 0.1\text{M}$
III. $K_c = Q$ when point D or F is reached
(1) I, II (2) II, III (3) I, III (4) I, II, III

10. In the following equilibrium :-

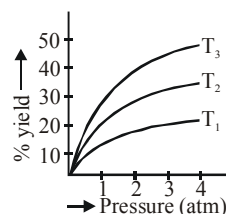
- I. $\text{A} + 2\text{B} \rightleftharpoons \text{C}$; K_1
II. $\text{C} + \text{D} \rightleftharpoons 3\text{A}$; K_2
III. $6\text{B} + \text{D} \rightleftharpoons 2\text{C}$; K_3 hence :-
(1) $3K_1 \times K_2 = K_3$
(2) $K_1^3 \times K_2^2 = K_3$
(3) $3K_1 \times K_2^2 = K_3$
(4) $K_1^3 \times K_2 = K_3$

11. For the gas phase reaction,
 $C_2H_{4(g)} + H_{2(g)} \rightleftharpoons C_2H_{6(g)}$;
 $\Delta H = -136.8 \text{ KJ mole}^{-1}$
 carried out in a vessel, the concentration of C_2H_4 can be increased by
 (a) increasing the temperature
 (b) decreasing the pressure
 (c) removing some H_2
 (d) adding some C_2H_6
 (1) (a), (b) (2) (b), (d)
 (3) (a), (b), (c) (4) (a), (b), (c), (d)
12. Consider the following reactions (in gaseous phase) in equilibrium with equilibrium concentrations 0.1 M of every species :-
 (I) $2SO_2 + O_2 \rightleftharpoons 2SO_3$;
 (II) $N_2 + 3H_2 \rightleftharpoons 2NH_3$;
 (III) $N_2O_4 \rightleftharpoons 2NO_2$;
 (IV) $4NO + 6H_2O \rightleftharpoons 4NH_3 + 5O_2$
 Extent of reaction will be in order :
 (1) I = II = III = IV (2) I = II = III < IV
 (3) III < I = IV < II (4) IV < III < I < II
13. $2NOBr(g) \rightleftharpoons 2NO(g) + Br_2(g)$. If nitrosyl bromide (NOBr) is 40% dissociated at certain temp. and a total pressure of 0.30 atm. K_p for the reaction $2NO(g) + Br_2(g) \rightleftharpoons 2NOBr(g)$ is
 (1) 45 (2) 25 (3) 0.022 (4) 0.25
14. Consider the reaction : $A(g) \rightleftharpoons B(g)$.
 One mole of A(g) is placed in a 1.0 L flask and the reaction is allowed to reach to equilibrium. A graph of the mole percent of A(g) and B(g) versus time is shown below :

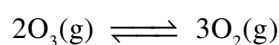


- The value of equilibrium constant is :
 (1) 2 (2) 0.67 (3) 0.75 (4) 1.25

15. The equilibrium constant for the reaction
 $H_2(g) + S(s) \rightleftharpoons H_2S(g)$; is 18.5 at 925 K and 9.25 at 1000 K respectively. The enthalpy of the reaction will be :
 (1) $-68000.05 \text{ J mol}^{-1}$ (2) $-71080.57 \text{ J mol}^{-1}$
 (3) $-80071.75 \text{ J mol}^{-1}$ (4) $57080.75 \text{ J mol}^{-1}$
16. At a particular time, the analysis shows that composition of the reaction mixture is 3 mol lit^{-1} N_2 , 2 mol lit^{-1} H_2 and 0.5 mol lit^{-1} NH_3 at 500 K. If equilibrium constant K_c for the reaction,
 $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ at 500 K is 0.061 $lit^2 \text{ mol}^{-2}$, in which direction the net reaction will go :-
 (1) Forward
 (2) Backward
 (3) Reaction is at equilibrium
 (4) Direction of reaction can not be predicted
17. The preparation of $SO_3(g)$ by reaction
 $SO_2(g) + \frac{1}{2} O_2(g) \rightleftharpoons SO_3(g)$
 is an exothermic reaction.
 If the preparation follows the following temperature-pressure relationship for its % yield, then for temperatures T_1, T_2 and T_3 .
 The correct option is : -
 (1) $T_3 > T_2 > T_1$ (2) $T_1 > T_2 > T_3$
 (3) $T_1 = T_2 = T_3$
 (4) Nothing could be predicted about temperature through given information.



18. The conversion of ozone into oxygen is exothermic. Under what conditions is ozone the most stable ?



- (1) At low pressure and low temperature
 (2) At high pressure and high temperature
 (3) At high pressure and low temperature
 (4) At low pressure and high temperature

19. For the dissociation reaction :



if $K_p = 25 \text{ atm}^2$; then the equilibrium pressure of the system is :-

- (1) 25 atm (2) 5 atm
(3) 10 atm (4) 15 atm

20. The standard free energy change for a gaseous reaction at 27°C is X Kcal. If equilibrium constant for a reaction is 100 and R is $2 \text{ cal K}^{-1} \text{ mol}^{-1}$. Then X is :-

- (1) -2.7636 (2) -0.6736
(3) +2.2636 (4) None

ALLEN

NOAH ..						ANSWER KEY										
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Ans.	1	1	1	3	4	1	2	1	2	4	4	3	1	2	2	
Que.	16	17	18	19	20											
Ans.	1	2	2	3	1											

IONIC EQUILIBRIUM

- pH of 0.01 M ammonium cyanide solution is 7.02. If 5 litres of water is added to this solution, the pH becomes :
(1) > 7.02
(2) < 7.02
(3) It is difficult to predict
(4) 7.02
- $\text{pOH} = 7 - 0.5 \text{pK}_a + 0.5 \text{pK}_b$, is true for which pair of cation and anion :
(1) $\text{C}_6\text{H}_5\text{NH}_3^+$, CH_3COO^-
(2) Na^+ , CN^-
(3) Al^{+3} , Cl^-
(4) NH_4^+ , NO_3^-
- Expression to evaluate solubility for Hg_2Cl_2 is
(1) $\left[\frac{K_{sp}}{108}\right]^{1/5}$
(2) $[K_{sp}]^{1/2}$
(3) $\left[\frac{K_{sp}}{4}\right]^{1/3}$
(4) $\left[\frac{K_{sp}}{16}\right]^{1/4}$
- If the solubility of calcium phosphate (molecular weight M) in water at 25°C is w g per 100 mL, its solubility product at 25°C is approximately :
(1) $10^9 \left(\frac{w}{M}\right)^5$
(2) $10^7 \left(\frac{w}{M}\right)^5$
(3) $10^5 \left(\frac{w}{M}\right)^5$
(4) $10^3 \left(\frac{w}{M}\right)^5$
- HX is a weak acid ($K_a = 10^{-5}$). It forms a salt NaX (0.1 M) on reacting with caustic soda. The degree of hydrolysis of NaX is :
(1) 0.01%
(2) 0.0001%
(3) 0.1%
(4) 0.5%
- $\text{CH}_3\text{COOH} + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}_3\text{O}^+$
In the above process, conjugate base of strong acid is :
(1) H_2O
(2) CH_3COO^-
(3) CH_3COOH
(4) H_3O^+
- The pH of a solution is 13. What is the number of H^+ ions in 1 mL of the solution ?
(1) 6.02×10^{23}
(2) 6.02×10^{13}
(3) 6.02×10^7
(4) 6.02×10^{10}
- Which of the following solution will have pH close to 1.0 ?
(1) 100 mL. of $\left(\frac{M}{10}\right)\text{HCl} + 100 \text{ mL of } \left(\frac{M}{10}\right)\text{NaOH}$
(2) 55 mL. of $\left(\frac{M}{10}\right)\text{HCl} + 45 \text{ mL of } \left(\frac{M}{10}\right)\text{NaOH}$
(3) 10 mL. of $\left(\frac{M}{10}\right)\text{HCl} + 90 \text{ mL of } \left(\frac{M}{10}\right)\text{NaOH}$
(4) 75 mL. of $\left(\frac{M}{5}\right)\text{HCl} + 25 \text{ mL of } \left(\frac{M}{5}\right)\text{NaOH}$
- Which of the following will act as a buffer :
(a) $\text{NaCl} + \text{NaOH}$
(b) Borax + boric acid
(c) $\text{NaH}_2\text{PO}_4 + \text{Na}_2\text{HPO}_4$
(d) $\text{NH}_4\text{Cl} + \text{NH}_4\text{OH}$
(1) b, c and d
(2) b and c
(3) a, c and d
(4) b and d
- Solubility product (K_{sp}) of salts of type MX, MX_2 , M_3X at temperature T are 4×10^{-8} , 3.2×10^{-14} and 2.7×10^{-15} respectively. Solubility of the salts at temperature T are in the order :-
(1) $\text{MX} > \text{MX}_2 > \text{M}_3\text{X}$
(2) $\text{MX}_2 > \text{M}_3\text{X} > \text{MX}$
(3) $\text{M}_3\text{X} > \text{MX}_2 > \text{MX}$
(4) $\text{MX} > \text{M}_3\text{X} > \text{MX}_2$
- The amino acid glycine exists predominantly in the form $\text{NH}_3^+\text{CH}_2\text{COO}^-$ its conjugate base and conjugate acid will be respectively :
(1) $\text{NH}_2\text{CH}_2\text{COO}^-$, $\text{NH}_3^+\text{CH}_2\text{COOH}$
(2) $\text{NH}_2\text{CH}_2\text{COOH}$, $\text{NH}_2\text{CH}_2\text{COO}^-$
(3) $\text{NH}_3^+\text{CH}_2\text{COOH}$, $\text{NH}_2\text{CH}_2\text{COO}^-$
(4) None

12. Consider the following :

- A. Sodium acetate
- B. Acetic acid + Sodium acetate
- C. Acetic acid

The pH of their equimolar aqueous solutions will be such that :

- (1) $C < B < A$
- (2) $B < A < C$
- (3) $A < B < C$
- (4) $C < A < B$

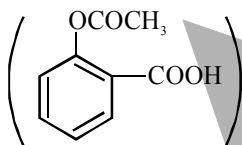
13. Nicotinic acid ($K_a = 10^{-5}$) is represented by the formula HNiC . Calculate percent dissociation in a solution which contains 0.1 mol of nicotinic acid per 2 litre of solution :

- (1) 1.4%
- (2) 1.6%
- (3) 2.4%
- (4) 3.4%

14. Calculate the pH at equivalence point when a solution of 0.1 M CH_3COOH is titrated with a solution of 0.1 M KOH .

- (K_a of $\text{CH}_3\text{COOH} = 2 \times 10^{-5}$)
- (1) 5.3
 - (2) 7.3
 - (3) 10.7
 - (4) 8.7

15. Acetyl salicylic acid called aspirin (shown in figure) is a pain killer with $\text{p}K_a = 4$. If two tablets each of 0.09 g mass containing aspirin are dissolved in 100 mL solution. Its pH will be



- (1) 0.5
- (2) 1.0
- (3) 1.8
- (4) 3

16. Calculate the solubility of silver phosphate (Ag_3PO_4) in 0.1 M AgNO_3

(K_{sp} of $\text{Ag}_3\text{PO}_4 = 1.1 \times 10^{-16}$) :-

- (1) 1×10^{-8} M
- (2) 4×10^{-15} M
- (3) 1.1×10^{-15} M
- (4) 1.1×10^{-13} M

17. A certain acidic indicator has $\text{pH} = 5.48$. 75% of the indicator exists in its ionised form. Calculate K_a of the indicator.

- (1) 1×10^{-5}
- (2) 2×10^{-5}
- (3) 1×10^{-3}
- (4) 4×10^{-5}

18. Two sparingly soluble salts AX and BX_2 have their solubility product constants equal. Which of the following is incorrect ?

- (1) Solubility of AX is less than solubility of BX_2
- (2) If S_1 and S_2 are molar solubility of AX and BX_2 then $S_1 = 2(S_2)^{2/3}$
- (3) If X is a conjugate base of a weak acid, addition of HNO_3 will increase solubility of both AX and BX_2
- (4) Increasing the temperature, increases the solubility of both AX and BX_2

19. What is the % dissociation of 0.01N NH_4OH in its buffer solution containing 0.01N NH_4Cl :- (K_b of $\text{NH}_4\text{OH} = 2 \times 10^{-5}$)

- (1) 0.2%
- (2) $2 \times 10^{-3}\%$
- (3) 2×10^{-5}
- (4) $5 \times 10^{-3}\%$

20. In which of the following combination, is buffer action expected ?

- (a) $\text{NH}_4\text{OH} + \text{NH}_4\text{Cl}$
- (b) $\text{HCl} + \text{NaCl}$
- (c) $\text{NH}_4\text{OH} + \text{HCl}$ in 2 : 1 mole ratio

Select the correct answer using the code given below :

- (1) a & b
- (2) a & c
- (3) a, b & c
- (4) None of these

21. Silver ions are added to a solution with $[\text{Br}^-] = [\text{Cl}^-] = [\text{CO}_3^{2-}] = [\text{AsO}_4^{3-}] = 0.1\text{M}$.

Which compound will precipitate with lowest $[\text{Ag}^+]$?

- (1) AgBr ($K_{sp} = 5 \times 10^{-13}$)
- (2) AgCl ($K_{sp} = 1.8 \times 10^{-10}$)
- (3) Ag_2CO_3 ($K_{sp} = 8.1 \times 10^{-12}$)
- (4) Ag_3AsO_4 ($K_{sp} = 1 \times 10^{-22}$)

22. Find the pH of a solution obtained by mixing 25 mL, 0.5 M HCl solution, 10 mL, 0.5 M NaOH solution and 15 mL of water :-

- (1) 1.82
- (2) 0.48
- (3) 0.82
- (4) 12.1

23. The pH of 0.5 M NaCN solution is (K_a of $\text{HCN} = 5 \times 10^{-10}$)

- (1) 11.5
- (2) 2.5
- (3) 12.5
- (4) 1.5

24. What is the maximum concentration of equimolar solutions of FeSO_4 and Na_2S so that when mixed in equal volumes, there is no precipitation of FeS ?
(K_{sp} of $\text{FeS} = 6.25 \times 10^{-18}$)
(1) 5×10^{-9} M (2) 5×10^{-8} M
(3) 5×10^{-18} M (4) 5×10^{-19} M
25. How many moles of HCN will be required to prepare one litre buffer solution of $\text{pH} = 10.4$ using 0.01 mole NaCN ?
(Given $K_a(\text{HCN}) = 4 \times 10^{-10}$)
(1) 2×10^{-2} mol (2) 1×10^{-3} mol
(3) 4×10^{-4} mol (4) 9×10^{-3} mol
26. The pH of two equimolar weak acids are 3 and 5 respectively. Their relative strength is :-
(1) 3 : 5 (2) 5 : 3
(3) 100 : 1 (4) 1 : 100
27. 400 mL of 0.1 M KCN and 200 mL of 0.1 M HCl are mixed at 25°C . Determine the pH of the mixture. ($\text{p}K_a$ for $\text{HCN} = 6$)
(1) 8 (2) 4 (3) 6 (4) 2
28. How many gram of H_2SO_4 should be removed from 1 L of its aqueous solution of $\text{pH} = 2$ to increase its pH upto 3.
(1) 49 g (2) 9.8 g (3) 0.49 g (4) 0.441 g
29. 20 ml of 0.5 N HCl and 35 ml of 0.1 N NaOH are mixed. The resulting solution will :-
(1) be neutral
(2) be basic
(3) turn phenol phthalein solution pink
(4) turn methyl orange solution red
30. The solubility of $\text{Pb}(\text{OH})_2$ in water is 5×10^{-6} M. Calculate the solubility of $\text{Pb}(\text{OH})_2$ in a buffer solution of $\text{pH} = 8$ at 25°C .
(1) 2.5×10^{-4} M (2) 5×10^{-16} M
(3) 5×10^{-4} M (4) 2.5×10^{-16} M

NOAH..

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	1	3	2	1	1	3	4	1	4	1	1	1	4	4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	4	1	2	1	2	1	3	1	1	2	3	3	4	4	3

THERMODYNAMICS AND THERMO CHEMISTRY

- Standard enthalpies of formation of O_3 , CO_2 , NH_3 and HI are 142.2, -393.2, -46.2 and +25.9 kJ mol⁻¹ respectively. The order of their increasing stabilities will be :-
 (1) O_3 , CO_2 , NH_3 , HI
 (2) CO_2 , NH_3 , HI , O_3
 (3) O_3 , HI , NH_3 , CO_2
 (4) NH_3 , HI , CO_2 , O_3
- The amount of heat released when 20 mL of 0.5 M NaOH is mixed with 100 mL of 0.1 M HCl is x kJ. The heat of neutralisation (in kJ mol⁻¹) is :-
 (1) -100 x (2) -50 x
 (3) +100 x (4) +50x
- What will be the heat of formation of methane, if the heat of combustion of carbon is '-x' kJ, heat of formation of water is '-y' kJ and heat of combustion of methane is '-z' kJ ?
 (1) $(-x - y + z)$ kJ
 (2) $(-z + x + 2y)$ kJ
 (3) $(-x - 2y - z)$ kJ
 (4) $(-x - 2y + z)$ kJ
- How much energy is absorbed by 10 mol of an ideal gas if it expands reversibly from an initial pressure of 8 atm. to 4 atm at a constant temperature of 27°C ?
 (1) 1.728×10^4 J (2) 2×10^5 J
 (3) 8×10^6 J (4) 1.728×10^5 J
- Which reaction occurs with the greatest increase in entropy ?
 (1) $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$
 (2) $2NO(g) \rightarrow N_2(g) + O_2(g)$
 (3) $C(s) + O_2(g) \rightarrow CO_2(g)$
 (4) $Br_2(g) + Cl_2(g) \rightarrow 2BrCl(g)$
- In which of the reactions at constant pressure sign of work done is -ve.
 (1) $H_2O(s) \rightarrow H_2O(g)$
 (2) $H_2O(l) \rightarrow H_2O(s)$
 (3) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
 (4) All of these
- (i) $2B_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow B_2O_{3(s)}$
 $\Delta H = -1273$ KJ mol⁻¹
 (ii) $H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(l)}$
 $\Delta H = -286$ KJ mol⁻¹
 (iii) $H_2O_{(l)} \rightarrow H_2O_{(g)}$ $\Delta H = 44$ KJ mol⁻¹
 (iv) $2B_{(s)} + 3H_{2(g)} \rightarrow B_2H_{6(g)}$
 $\Delta H = 36$ KJ mol⁻¹
 From the above data, calculate the enthalpy change for the combustion of $B_2H_{6(g)}$.
 $B_2H_{6(g)} + 3O_{2(g)} \rightarrow B_2O_{3(s)} + 3H_2O_{(g)}$
 (1) -1835 KJ mol⁻¹ (2) 2035 KJ mol⁻¹
 (3) -2035 KJ mol⁻¹ (4) None of these
- The entropies of $H_2(g)$ and $H(g)$ are 130.6 and 114.6 Jmol⁻¹ K⁻¹ respectively at 298K. Bond energy of H_2 (in kJ mol⁻¹) J is-
 Given-
 $H_2(g) \rightarrow 2H(g)$; $\Delta G^\circ = 406.62$ kJ mol⁻¹
 (1) 364 kJ (2) 643 kJ (3) 436 kJ (4) 346 kJ
- The latent heat of vaporisation of a liquid at 500 K and 1 atm pressure is 10 kCal/mol. What will be the change in internal energy (ΔU) during vaporisation of 3 moles of the liquid at the same temperature and pressure?
 (1) 13 kCal (2) -13 kCal
 (3) 27 kCal (4) -27 kCal
- One gram sample of NH_4NO_3 is decomposed in a bomb calorimeter. The temperature of the calorimeter increase by 6.12 K. The heat capacity of the system is 1.23 kJ/g/K. What is the molar heat of decomposition for NH_4NO_3
 (1) 7.53 kJ/mol (2) 398.1 kJ/mol
 (3) 16.1 kJ/mol (4) 602 kJ/mol
- Consider the reaction at 300 K
 $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$, $\Delta H^\circ = -185$ kJ mol⁻¹
 If 3 mole of H_2 completely react with 3 mol of Cl_2 to form HCl , ΔU° of the reaction will be :-
 (1) Zero (2) -185 kJ
 (3) -555 kJ (4) -200 kJ

12. For which process will ΔH° and ΔG° be expected to be most similar :-

- (1) $2\text{Al(s)} + \text{Fe}_2\text{O}_3\text{(s)} \rightarrow 2\text{Fe(s)} + \text{Al}_2\text{O}_3\text{(s)}$
- (2) $2\text{Na(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)} + \text{H}_2\text{(g)}$
- (3) $2\text{NO}_2\text{(g)} \rightarrow \text{N}_2\text{O}_4\text{(g)}$
- (4) $2\text{H}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{H}_2\text{O(g)}$

13. Consider the following statements :

- I. Change in state function between two states is a definite quantity and does not depend on path.
- II. Intensive properties can't be algebraically added or subtracted.
- III. Ratio of two extensive properties result into a parameter that depends on amount of substance.
- IV. Molar heat capacity is an intensive property.

The correct order of true / false of the above statements is

- (1) F T F T
- (2) F F F T
- (3) T T F T
- (4) T T T F

14. Consider the following statements :-

- I. ΔG is negative for a physical process $\text{H}_2\text{O(l)} \rightarrow \text{H}_2\text{O(s)}$ at -20°C .
- II. Molar entropy of vapourisation of ice is negative.
- III. In reversible adiabatic process, heat involved is zero and therefore entropy change will be zero.
- IV. At absolute zero temperature, entropy of a pure perfectly crystalline substance is zero.

The correct order of true / false of the above statements is

- (1) T T T T
- (2) T F T T
- (3) F F F T
- (4) T F F T

15. $(\Delta H - \Delta E)$ is maximum at a given temperature in case of :-

- (1) $\text{PCl}_5\text{(g)} \rightarrow \text{PCl}_3\text{(g)} + \text{Cl}_2\text{(g)}$
- (2) $\text{CaCO}_3\text{(s)} \rightarrow \text{CaO(s)} + \text{CO}_2\text{(g)}$
- (3) $\text{NH}_4\text{HS(s)} \rightarrow \text{NH}_3\text{(g)} + \text{H}_2\text{S(g)}$
- (4) $\text{N}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{NO(g)}$

16. Which has the highest entropy per mol of the substance :-

- (1) H_2 at 25°C and 1 atm
- (2) H_2 at STP
- (3) H_2 at 100 K and 1 atm
- (4) H_2 at 0 K and 1 atm

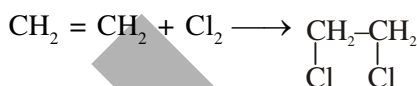
17. One mol of NaCl(s) on melting absorbed 30.5 kJ of heat and its entropy is increased by 28.8 J K^{-1} . What is the melting point of sodium chloride :-

- (1) 750 K
- (2) 1059 K
- (3) 1332 K
- (4) 786 K

18. Temperature of 1 mol of a gas is increased by 1°C at constant pressure. The magnitude of work done is :-

- (1) R
- (2) 2 R
- (3) $\frac{R}{2}$
- (4) 3 R

19. Use the bond energies in the table to calculate ΔH for the reaction :



Bond	C-C	C=C	C-Cl	C-H	Cl-Cl
Bond energy (KJ/mole)	347	612	331	414	243

- (1) $\Delta H = -684 \text{ KJ}$
- (2) $\Delta H = -154 \text{ KJ}$
- (3) $\Delta H = +89 \text{ KJ}$
- (4) $\Delta H = +177 \text{ KJ}$

20. When one mole of an ideal gas is compressed to half its initial volume and simultaneously heated to twice its initial temperature, the change in entropy (ΔS) is :-

- (1) $C_V \ln 2$
- (2) $C_P \ln 2$
- (3) $R \ln 2$
- (4) $(C_V - R) \ln 2$

21. What are the signs of the entropy change (+ or -) in the following :-

I : A liquid crystallises into a solid

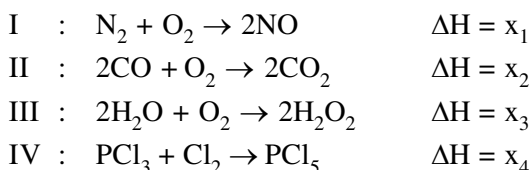
II : Temperature of a crystalline solid is raised from 0 K to 115 K

III : $2\text{NaHCO}_3\text{(s)} \rightarrow \text{Na}_2\text{CO}_3\text{(s)} + \text{CO}_2\text{(g)} + \text{H}_2\text{O(g)}$

IV : $\text{H}_2\text{(g)} \rightarrow 2\text{H(g)}$

	I	II	III	IV
(1) -	+	+	+	+
(2) -	-	-	-	+
(3) -	-	-	-	+
(4) +	-	-	-	-

22. Consider following reactions :-



In which case(s), $\Delta H_f = \frac{\Delta H}{2}$

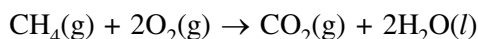
- (1) I, II, III (2) IV
 (3) II, III (4) I

23. Calorific value of H_2 is -143 kJ g^{-1} , Hence,

ΔH_f° of H_2O is :-

- (1) -143 kJ mol^{-1} (2) -286 kJ mol^{-1}
 (3) $+143 \text{ kJ mol}^{-1}$ (4) $+286 \text{ kJ mol}^{-1}$

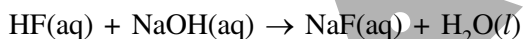
24. Heat of combustion of CH_4 at 25°C and 1 atm constant pressure is $-210 \text{ kcal mol}^{-1}$



Hence, heat of combustion at constant volume is :-

- (1) $-210 \text{ kcal mol}^{-1}$ (2) $-198 \text{ kcal mol}^{-1}$
 (3) $-208.8 \text{ kcal mol}^{-1}$ (4) $-211.2 \text{ kcal mol}^{-1}$

25. In the following reaction, involving neutralisation of HF (a weak acid) with NaOH (a strong base).



$\Delta H^\circ = -68.6 \text{ kJ mol}^{-1}$

This value is much higher than the heat of neutralisation of strong acid with strong base ($= -57.3 \text{ kJ mol}^{-1}$). This is due to :

- (1) In aqueous solution, HF behaves as a strong acid
 (2) There is hydration of F^- ion in aqueous solution, and the process is exothermic
 (3) Both (1) and (2)
 (4) Can't be predicted

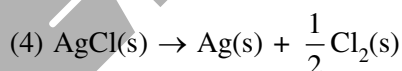
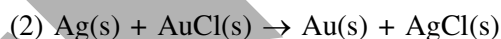
26. In a closed container of 1.0 litre capacity 2 mole of CO and 1 mole of O_2 gases at 500 K and 70 atm react to form 2 mole of CO_2 gas. The pressure decreases to 40 atm at 500 K due to the following reaction :



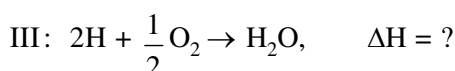
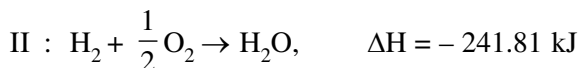
Calculate ΔU for the reaction at 500 K. 1 litre-atm = 0.1 kJ. All the above gases show significant deviations from ideal gas behaviour.

- (1) -557 kJ (2) -590 kJ
 (3) $+557 \text{ kJ}$ (4) $+590 \text{ J}$

27. The enthalpy change for which of the following processes represents the enthalpy of formation of AgCl :-



28. In the reactions



H_2O can be formed either by II or III. Ratio of enthalpy change in III to II is :-

- (1) 2.8 (2) 0.36 (3) 1.2 (4) 0.82

29. 5 moles of a gas (assuming ideal) expand adiabatically and reversibly by doing work of 250 R and undergo the decrease in temperature of 20°C . The gas is :-

- (1) He (2) CO (3) NH_3 (4) CO_2

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	1	4	1	1	4	3	3	3	4	3	1	3	2	3
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
Ans.	1	2	1	2	4	1	4	2	3	2	1	3	1	2	

REDOX REACTION

1. When ferrous oxalate is titrated against $K_2Cr_2O_7$, meq. of Fe^{2+} , $C_2O_4^{2-}$ and $Cr_2O_7^{2-}$ in the redox reaction are X, Y and Z respectively, then:-
 (1) $X = Y$ (2) $X + Y = Z$
 (3) $X + 2Y = Z$ (4) $2X + 6Y = 6Z$

2. Match incorrect equivalent mass of reactant in following column ? (M = molar mass of reactant):-

Column-I

Column-II

- | | |
|--|----------------|
| (1) $FeS_2 \rightarrow Fe^{3+} + SO_3$ | $\frac{M}{15}$ |
| (2) $P_2H_4 \rightarrow P_4H_2 + PH_3$ | $\frac{5M}{6}$ |
| (3) $2Mn^{+7} \rightarrow Mn^{2+} + Mn^{+6}$ | $\frac{M}{3}$ |
| (4) $Ba(MnO_4)_2 \xrightarrow{H^+} Mn^{2+}$ | $\frac{M}{5}$ |

3. What mass of MnO_2 is reduced by 35 mL of 0.16 N oxalic acid in acidic solution ? The skeleton equation is ($Mn = 55$) :-
 $MnO_2 + H^+ + H_2C_2O_4 \rightarrow CO_2 + H_2O + Mn^{2+}$
 (1) 8.7 g (2) 0.24 g (3) 0.84 g (4) 43.5 g

4. How many gram of $KMnO_4$ are contained in 4 litre of 0.05 N solution. The $KMnO_4$ is to be used as an oxidant in acidic medium ?
 (1) 1.58 g (2) 15.8 g
 (3) 6.32 g (4) 31.6 g

5. A compound contains element X, Y, Z with oxidation no. +3, +5 and -2 respectively. What will be possible formula of compound containing above element.
 (1) XYZ (2) $Y_2(XZ_3)_2$
 (3) $X_3(YZ_4)_3$ (4) $X_3(Y_4Z)_2$

6. Which of the following can only act as oxidising agent?
 (1) $KMnO_4$ (2) K_2MnO_4
 (3) H_2O_2 (4) SO_2

7. How many moles of $FeSO_4$, $H_2C_2O_4$ and FeC_2O_4 are oxidised separately by one mole of $KMnO_4$ in acidic medium respectively :-
 (1) 5 ; 5/2 ; 5/3 (2) 2/5 ; 2 ; 5
 (3) 5/3 ; 3/5 ; 2/5 (4) 3/5 ; 2 ; 5

8. Which of the following reagent can act as reducing agent with SO_2 :-
 (1) F_2 (2) $KMnO_4$
 (3) HNO_3 (4) H_2S

9. Which of the following is not a disproportionation reaction :-
 (1) $P_4 + NaOH \rightarrow NaH_2PO_2 + PH_3$
 (2) $BaC_2 + N_2 \rightarrow Ba(CN)_2$
 (3) $Hg_2I_2 \rightarrow HgI_2 + Hg$
 (4) $Cl_{2(g)} + 2OH^-_{(aq)} \rightarrow ClO^-_{(aq)} + Cl^-_{(aq)} + H_2O$

10. Which of the following is correctly match :-

Compound	Oxidation number			
(a) $\underline{A}lF_3$			(P)	+2.5
(b) $P_4\underline{O}_{10}$			(Q)	+7
(c) $H\underline{C}lO_4$			(R)	+5
(d) $\underline{S}_4O_6^{2-}$			(S)	+3
(a)	(b)	(c)	(d)	
(1) P	Q	R	S	
(2) S	R	Q	P	
(3) S	R	P	Q	
(4) P	Q	S	R	

11. When BrO_3^- ion reacts with Br^- in acidic medium, Br_2 is liberated. The equivalent weight of Br_2 in this reaction is :-

- (1) $\frac{5M}{8}$ (2) $\frac{5M}{3}$ (3) $\frac{3M}{5}$ (4) $\frac{4M}{6}$

12. An element 'A' in a compound ABD has oxidation number -n. It is oxidised by $Cr_2O_7^{2-}$ in acidic medium. In the experiment 1.68×10^{-3} moles of $K_2Cr_2O_7$ were used for 3.36×10^{-3} moles of ABD. The new oxidation number of A after oxidation is :-

- (1) 3 (2) 3 - n
 (3) n - 3 (4) + n

13. $N_2 + 3H_2 \longrightarrow 2NH_3$ molecular weight of NH_3 and N_2 are x_1 and x_2 their equivalent weight are y_1 and y_2 . Then $(y_1 - y_2)$ is :-

- (1) $\left(\frac{2x_1 - x_2}{6}\right)$ (2) $(x_1 - x_2)$
(3) $(3x_1 - x_2)$ (4) $(x_1 - 3x_2)$

14. In the following redox reaction :-
 $Cu_3P + Cr_2O_7^{2-} \longrightarrow Cu^{+2} + H_3PO_4 + Cr^{+3}$
equivalent weight of Cu_3P is

- (1) $\frac{M}{3}$ (2) $\frac{M}{11}$ (3) $\frac{M}{8}$ (4) $\frac{M}{13}$

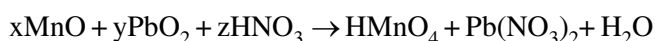
15. Which of the following is not disproportionation

- (1) $P_4 + 5OH^- \rightarrow H_2PO_4^- + PH_3$
(2) $Cl_2 + OH^- \rightarrow Cl^- + ClO^-$
(3) $2H_2O_2 \rightarrow 2H_2O + O_2$
(4) $PbO_2 + H_2O \rightarrow PbO + H_2O_2$

16. Which of the following is intermolecular redox reaction :-

- (1) $\begin{array}{ccc} CHO & & CH_2OH \\ | & \xrightarrow{OH^-} & | \\ CHO & & COOH \end{array}$
(2) $2C_6H_5CHO \xrightarrow{Al(OC_2H_5)_3} C_6H_5COOH + C_6H_5CH_2OH$
(3) $4CrO_5 + 6H_2SO_4 \rightarrow 2Cr_2(SO_4)_3 + 6H_2O + 7O_2$
(4) $As_2S_3 + HNO_3 \rightarrow H_3AsO_4 + H_2SO_4 + NO$

17. In the redox reaction



- (1) $x = 2, y = 5, z = 10$
(2) $x = 2, y = 7, z = 8$
(3) $x = 2, y = 5, z = 8$
(4) $x = 2, y = 5, z = 5$

18. Hydrazine reacts with KIO_3 in presence of HCl as;
 $N_2H_4 + IO_3^- + 2H^+ + Cl^- \rightarrow ICl + N_2 + 3H_2O$

The equivalent masses of N_2H_4 and KIO_3 respectively are : ($K = 39, I = 127$) :-

- (1) 8,87 (2) 8,35.6
(3) 16,53.5 (4) 8,53.5

19. 12.5 mL of 0.05 M SeO_2 oxidises 25 mL of 0.1 M $CrSO_4$ solution to $Cr_2(SO_4)_3$. What is the final oxidation number of Se ?

- (1) +2 (2) +4 (3) +6 (4) 0

20. What is the equivalent mass of As_2S_3 in the following reaction : (Molar mass of $As_2S_3 = M$)
 $As_2S_3 + NO_3^- + H^+ \rightarrow As_2O_5 + NO_2^- + SO_3 + H_2O$
(1) $M/4$ (2) $M/24$ (3) $M/28$ (4) $M/12$

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	4	2	3	3	1	1	4	2	2	3	2	1	2	4
Que.	16	17	18	19	20										
Ans.	4	1	4	4	3										

BEHAVIOUR OF GASES

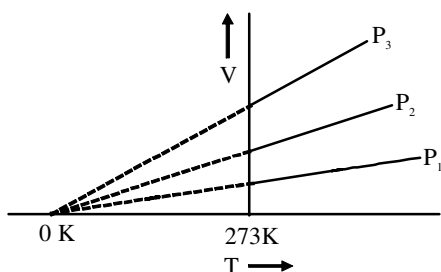
- 20 L of SO_2 gas is diffused in 120 sec. Then find out the volume of O_2 gas to diffuse in 60 sec.
(1) 14.14 L (2) 12.12 L
(3) 18.18 L (4) 20 L
- An unknown gas, X, has rate of diffusion measured to be 0.88 times that of PH_3 at the same conditions of T and P. The gas will be :-
(1) C_2H_6 (2) CO (3) NO_2 (4) N_2O
- Under what conditions will a pure sample of ideal gas not only exhibit a pressure of 1 atm, but also a concentration of 2 moles per litre :-
(1) At STP
(2) When $V = 22.4$ litres
(3) When R has no units
(4) At 6.1 K
- The compressibility factor (z) of an ideal gas is :
(1) 0 (2) ∞ (3) -1 (4) 1
- Gas A diffuses 5 times faster than gas B. Then find out the ratio of density of A and B :
(1) 25 : 1 (2) 5 : 1 (3) 1 : 25 (4) 1 : 5
- The compression factor (compressibility factor) for one mole of a van der Waal's gas at 0°C and 100 atm is found to be 0.5. Assuming that the volume of a gas molecule is negligible, calculate the van der Waals' constant 'a'.
(1) $1.253 \text{ L}^2\text{mol}^{-2}\text{atm}$ (2) $2.501 \text{ L}^2\text{mol}^{-2}\text{atm}$
(3) $3.753 \text{ L}^2\text{mol}^{-2}\text{atm}$ (4) $4.210 \text{ L}^2\text{mol}^{-2}\text{atm}$
- A mixture of CH_4 and HBr , in a vessel are allowed to effuse out through a small hole at the constant temperature. What is the mole fraction of CH_4 , if the initial rates of effusion are the same for both gases (atomic weight of Br = 80) :-
(1) 0.31 (2) 0.44 (3) 0.69 (4) 0.16
- X mL of H_2 gas effuses through a hole in a container in 5 seconds. The time taken for the effusion of the same volume of gas specified below under identical condition is :-
(1) 10 seconds, helium
(2) 20 seconds, oxygen
(3) 25 seconds, carbon monoxide
(4) 55 seconds, carbon dioxide
- Select the gas which can be liquefied :-
(1) Gas obeying $P(V-b) = RT$
(2) Gas obeying $PV = RT$
(3) Gas obeying $\left[P + \frac{a}{V^2}\right][V-b] = RT$
(4) Gas obeying Maxwell velocity distribution curves rigidly
- The van der Waal's equation for 0.5 mol gas is
(1) $\left(P + \frac{a}{4V^2}\right)\left(\frac{V-b}{2}\right) = \frac{2RT}{2}$
(2) $\left(P + \frac{a}{4V^2}\right)(2V-b) = RT$
(3) $\left(P + \frac{a}{4V^2}\right)(2V-4b) = RT$
(4) $\left(P + \frac{a}{4V^2}\right) = \frac{2RT}{2(V-b)}$
- Select the correct statements about van der Waal's constant 'b' :-
a. It is excluded volume
b. Its unit is Lmol^{-1}
c. It depends on intermolecular force
d. Its value depends on molecular size
(1) b, c (2) a, b, d
(3) b, c, d (4) c, d

12. For H_2 and He, the approximation of the vander Waal's equation at any pressure ($P > 0$) is:-

(1) $\left(P + \frac{a}{V^2}\right)V = RT$ (2) $PV = RT$

(3) $PV - Pb = RT$ (4) $PV = Pb - RT$

13. The volume-temperature graphs of a given mass of an ideal gas at constant pressures are shown below. What is the correct order of pressures ?



- (1) $P_1 > P_3 > P_2$ (2) $P_1 > P_2 > P_3$
(3) $P_2 > P_3 > P_1$ (4) $P_2 > P_1 > P_3$

14. Which of the following conditions are favourable for liquefaction of gas ?

- (1) $T > T_c; P > P_c$
(2) $T < T_c; P > P_c$
(3) $T = T_c, P = P_c$
(4) $T = T_c, P < P_c$

15. For van der Waal's constants 'a' and 'b', the unit

of the ratio $\frac{a}{b}$ will be :-

- (1) atm litre^{-1}
(2) $\text{litre-atm mol}^{-1}$
(3) $\text{litre-atm mol}^{-2}$
(4) litre mol^{-1}

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	4	4	4	3	1	3	2	3	2	2	3	2	2	2

SOLID STATE

- Lithium crystallizes as body centered cubic crystals. If the length of the side of unit cell is 350 pm, the atomic radius of lithium is :-
(1) 303.1 pm (2) 606.2 pm
(3) 151.5 pm (4) 123.7 pm
- Each edge of a cubic unit cell is 400 pm. If atomic weight of the element is 120 and density is 6.25 g/cm^3 . The crystal lattice is :
(use $N_A = 6 \times 10^{23}$)
(1) primitive
(2) body centered
(3) face centered
(4) end centered
- An element crystallizes in a face centered cubic lattice crystal and the edge of the unit cell is 0.5 nm. The density is 3.2 g/cm^3 . What is the atomic weight ?
(1) 100 (2) 80
(3) 40 (4) 60
- An element X (Atomic weight. = 80 g/mol) having fcc structure, calculate number of unit cells in 8 gm of X :
(1) $0.4 \times N_A$ (2) $0.1 \times N_A$
(3) $4 \times N_A$ (4) $0.025 \times N_A$
- In a solid, oxide ions are cubical-closest packed whereas $1/8$ th of tetrahedral voids are occupied by A^{2+} cation and $1/2$ of octahedral voids are occupied by B^{3+} cations. The simplest formula of the compound is :
(1) $A_2B_2O_4$ (2) AB_2O_4
(3) $A_2B_4O_2$ (4) $A_4B_2O_2$
- In sodium chloride crystal, the number of next nearest neighbours of each Na^+ ions is :-
(1) 8 Cl^- ions (2) 12 Na^+ ions
(3) 12 Cl^- ions (4) 24 Cl^- ions
- A certain sample of cuprus sulphide is found to have composition $Cu_{1.8}S$, because of presence of some Cu^{2+} ions in the lattice. What is the mole % of Cu^{2+} in crystal ?
(1) 99.8%
(2) 11.11%
(3) 88.88%
(4) None of these
- When heated above 916°C , iron changes its bcc crystalline form to fcc without the change in the radius of atom. The ratio of density of the crystal before heating and after heating is :
(1) 1.069 (2) 0.918
(3) 0.725 (4) 1.231
- Ferrous oxide has a cubic structure and edge length of the unit cell is $5.0 \text{ \AA}$. Assuming the density of ferrous oxide to be 3.84 g/cm^3 , the number of Fe^{2+} and O^{2-} ions present in each unit cell be : (use $N_A = 6 \times 10^{23}$) :-
(1) 4 Fe^{2+} and 4 O^{2-}
(2) 2 Fe^{2+} and 2 O^{2-}
(3) 1 Fe^{2+} and 1 O^{2-}
(4) 3 Fe^{2+} and 4 O^{2-}
- In fcc lattice, A, B, C, D atoms are arranged at corner, face centre, octahedral void and tetrahedral void respectively, then the body diagonal contains :-
(1) 2A, C, 2D (2) 2A, 2B, 2C
(3) 2A, 2B, 2D (4) 2A, 2D
- A crystal is made of particles X, Y and Z. X forms fcc packing. Y occupies all the octahedral voids of X and Z occupies all the tetrahedral voids. If all the particles along one body diagonal are removed then the formula of the crystal would be :-
(1) XYZ (2) X_2YZ_2
(3) $X_8Y_4Z_5$ (4) $X_5Y_4Z_8$

12. Doping of KCl crystals with CdCl_2 results in
 (1) Schottky defect
 (2) Frenkel defect
 (3) Substitutional cation vacancy
 (4) Formation of F-centres

13. An ionic compound AB has fluorite type structures. If the radius of B^- is 200 pm, then the radius of A^+ would be :-

- (1) 82.8 pm (2) 146.4 pm
 (3) 40 pm (4) 45 pm

14. Calculate the number of atoms in a cubic unit cell having one atom on each corner and two atoms at each body diagonal :-

- (1) 8 (2) 9 (3) 6 (4) 3

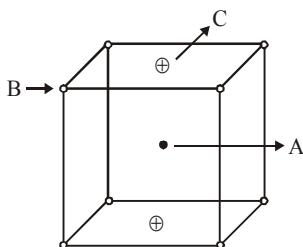
15. Find out formula of compound having spheres A, B and C. A is present at each element of ccp, B occupies 50% of octahedral voids and C occupies 50% of tetrahedral voids :-

- (1) AB_3C (2) A_2BC_4
 (3) AB_4C (4) A_2BC_2

16. In corundum, the oxide ions form the hexagonal close packing and aluminium ions occupy two third of the octahedral voids. What is the empirical formula of corundum :-

- (1) Al_6O_4 (2) Al_2O_3
 (3) AlO_2 (4) Al_2O

17. A solid ABC has A, B and C arranged as below.



The formula of solid is :-

- (1) ABC (2) AB_2C_2
 (3) A_2BC (4) AB_8C_2

18. In a face centred cubic arrangement of A and B atoms, atoms of A are at the corner of the unit cell and atoms of B are at the face centres. One of the A atom is missing from one corner in unit cell. The simplest formula of compound is :-

- (1) A_7B_3 (2) AB_3
 (3) A_7B_{24} (4) $\text{A}_{7/8}\text{B}_3$

19. In an ionic crystal A forms cubical close packing and B atoms are present at every tetrahedral voids. If any sample of crystal contain 'N' number of B atoms then number of A atoms in that sample is :-

- (1) N (2) $\frac{N}{2}$ (3) 2 N (4) $\sqrt{2}N$

20. In certain solid, the oxide ions are arranged in ccp. Cations A occupy $\frac{1}{6}$ of the tetrahedral voids and cations B occupy one third of the octahedral voids. The probable formula of the compound is :-

- (1) ABO_3 (2) AB_2O_3
 (3) A_2BO_3 (4) $\text{A}_2\text{B}_2\text{O}_3$

21. A mineral having formula AB_2 crystallises in the cubic close packed lattice, with the A atoms occupying the lattice points of CCP. Hence coordination number of A and B atoms are :-

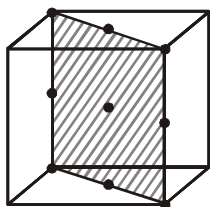
- (1) 4, 8 (2) 4, 4
 (3) 8, 8 (4) 8, 4

22. Number of formula units in unit cell of MgO (rock salt type), ZnS (zinc blende) respectively
 (1) 4, 3 (2) 4, 3 (3) 4, 4 (4) 4, 2

23. Number of unit cells in 10 g NaCl :-

- (1) $\frac{10N_A}{58.5}$ (2) $\frac{2.5}{58.5} \times N_A$
 (3) $\frac{5.6}{58.5} \times N_A$ (4) $\frac{5.6}{58.5} \times N_A \times 2$

24. A solid AB crystallises in NaCl structure. The anion B^- form fcc lattice, while the cation A^+ occupy all the octahedral holes. If all the particles as shown in the figure are removed, then the formula of solid becomes :-



- (1) AB (2) A_5B_7 (3) A_7B_5 (4) AB_2

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	2	4	4	2	2	2	2	1	1	4	3	4	2	4
Que.	16	17	18	19	20	21	22	23	24						
Ans.	2	1	3	2	1	4	3	2	1						

CHEMICAL KINETICS

1. In gaseous reaction it is important for the understanding of the upper atmosphere H_2O and O react bimolecularly to form two OH radicals. ΔH for this reaction is 72 kJ at 500 K and E_a is 77 kJ, then E_a for the bimolecular recombination of two OH radicals to form H_2O and O is :-

(1) 3 kJ (2) 4 kJ (3) 5 kJ (4) 7 kJ

2. Half lives and initial concentration of a first order and zero order reactions are same. Then the ratio of the initial rates of the first order reaction to that of zero order reaction is :-

(1) $1/0.693$ (2) 2×0.693
(3) $2/0.693$ (4) 6.93

3. In the following first order reactions

(A) $\xrightarrow{K_1}$ Product, (B) $\xrightarrow{K_2}$ Product,
the ratio K_1/K_2 if 90% of (A) has been reacted in time 't' while 99% of (B) has been reacted in time 2t is :-

(1) 1 (2) 2
(3) $1/2$ (4) $2 \left(\frac{1-2\log 3}{2-\log 11-2\log 3} \right)$

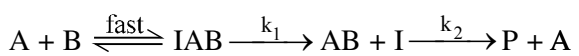
4. For a reaction : $\text{A} \longrightarrow \text{Product}$

Rate law is $-\frac{d[\text{A}]}{dt} = K[\text{A}]_0$

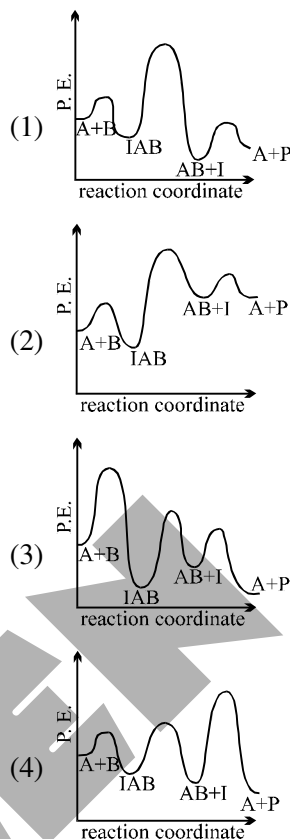
The concentration of A left after time t when $t = 1/K$ is :-

(1) $\frac{[\text{A}]_0}{e}$ (2) $[\text{A}]_0 e$ (3) $\frac{[\text{A}]_0}{e^2}$ (4) $\frac{1}{[\text{A}]_0}$

5. The following mechanism has been proposed for the exothermic catalyzed complex reaction.



If k_1 is much smaller than k_2 . The most suitable qualitative plot of potential energy (P.E.) versus reaction coordinate for the above reaction.



6. The reaction $\text{A}(\text{g}) + 2\text{B}(\text{g}) \longrightarrow \text{C}(\text{g}) + \text{D}(\text{g})$ is an elementary process. In an experiment, the initial partial pressure of A & B are $P_A = 0.6$ and $P_B = 0.8$ atm. Calculate the ratio of rate of reaction relative to initial rate when P_C becomes 0.2 atm.

(1) $\frac{1}{4}$ (2) $\frac{1}{10}$ (3) $\frac{1}{6}$ (4) 2

7. In the following reaction, rate constant is $1.2 \times 10^{-2} \text{ M s}^{-1}$ $\text{A} \longrightarrow \text{B}$. What is concentration of B after 10 min., if we start with 10 M of A.

(1) 2.8 M (2) 7.2 M (3) 8.2 M (4) 2.7 M

8. Two substances A ($t_{1/2} = 5$ min) and B ($t_{1/2} = 15$ min) follow first order kinetics are taken in such a way that initially $[\text{A}] = 4[\text{B}]$. Calculate the time after which the concentration of both the substance will be equal.

(1) 15 min (2) 20 min (3) 10 min (4) 25 min

9. A reaction takes place in three steps with individual rate constant and activation energy as follows-

	Rate constant	Activation energy
Step 1	k_1	$E_{a_1} = 180 \text{ kJ/mol}$
Step 2	k_2	$E_{a_2} = 80 \text{ kJ/mol}$
Step 3	k_3	$E_{a_3} = 50 \text{ kJ/mol}$

If overall rate constant, $(k) = \left(\frac{k_1 k_2}{k_3} \right)^{2/3}$, then

overall activation energy of the reaction will be:

- (1) 140 kJ/mol
(2) 150 kJ/mol
(3) 130 kJ/mol
(4) 120 kJ/mol
10. A first order reaction is 50% completed in 20 minutes at 27°C and in 5 min at 47°C . The energy of activation of the reaction is
(1) 43.85 kJ/mol (2) 55.14 kJ/mol
(3) 11.97 kJ/mol (4) 6.65 kJ/mol
11. Under the same reaction conditions, initial concentration is $1.386 \text{ mol dm}^{-3}$ of a substance becomes half in 40 seconds and 20 seconds through first order and zero order kinetics, respectively. Ratio $\left(\frac{k_1}{k_0} \right)$ of the rate constants for first order (k_1) and zero order (k_0) of the reactions is
(1) $0.5 \text{ mol}^{-1} \text{ dm}^3$
(2) 1.0 mol dm^{-3}
(3) $2.0 \text{ mol}^{-1} \text{ dm}^3$
(4) 0.1 mol dm^{-3}
12. The rate constant of a first order reaction at 37°C is 10^{-3} min^{-1} . The temperature coefficient of this reaction is 2. What is the rate constant (in min^{-1}) at 17°C for this reaction ?
(1) 10^{-3} (2) 5×10^{-4}
(3) 2.5×10^{-3} (4) 2.5×10^{-4}

13. Consider a chemical reaction involving compounds A and B, which is found to be first order in A and second order in B. At what rate will the reaction occur in experiment 2 ?

Experiment	Rate (Ms^{-1})	Initial [A]	Initial [B]
1	0.10	1.0 M	0.20 M
2	?	2.0 M	0.60 M

- (1) 1.8 M s^{-1} (2) 0.20 M s^{-1}
(3) 1.2 M s^{-1} (4) 0.36 M s^{-1}
14. In a reaction carried out at 400 K, 0.0001% of the total number of molecules are in activated state. The energy of activation of the reaction is
(1) zero
(2) 7.37 k cal/mol
(3) 9.212 k cal/mol
(4) 11.05 k cal/mol
15. A solution of N_2O_5 in CCl_4 yields 5 mL of O_2 by decomposition after 20 minutes from the start of the experiment and 10 mL of O_2 after a very long time. The decomposition obeys first order kinetics. What volume of O_2 would have evolved, 40 minutes after the start
(1) 7.5 mL (2) 7.25 mL (3) 1.5 mL (4) 6 mL
16. Two first-order reactions have half-lives in the ratio 3 : 2. Calculate the ratio of time intervals $t_1 : t_2$, t_1 is the time period for 25% completion of the first reaction and t_2 for 75% completion of the second reaction :-
(1) 0.311 : 1 (2) 0.420 : 1
(3) 0.273 : 1 (4) 0.119 : 1
17. A certain reaction obeys the rate equation (in the integrated form) $[C^{(1-n)} - C_0^{(1-n)}] = (n - 1)kt$ where n is the order of the reaction; C_0 the initial concentration and C , the concentration after time t . What is the unit of k for $n = 3$:-
(1) sec^{-1}
(2) $\text{litre mol}^{-1} \text{ sec}^{-1}$
(3) $\text{mol litre}^{-1} \text{ sec}^{-1}$
(4) $\text{litre}^2 \text{ mol}^{-2} \text{ sec}^{-1}$

18. The half-life of a first order reaction is one hour. During what time interval will the concentration be reduced to $\frac{7}{8}$ of its initial value :-
 (1) 6.32 minutes (2) 17.4 minutes
 (3) 23.2 minutes (4) 11.6 minutes
19. The time elapsed between 33% and 67% completion of a first order reaction is 30 minutes. What is the time needed for 25% completion :-
 (1) 15.5 min (2) 12.3 min
 (3) 18.5 min (4) 16.5 min
20. Kinetics of the reaction, $A(g) \longrightarrow 2B(g) + C(g)$ is followed by measuring the total pressure at different times. It is given that :
 Initial pressure of A = 0.5 atm.
 Total pressure of reaction mixture after 2 hours = 0.7 atm.
 Rate constant of the reaction = $1 \times 10^{-3} \text{ s}^{-1}$
 What is the rate of reaction when the total pressure is 0.7 atm ?
 (1) $2.0 \times 10^{-4} \text{ atm s}^{-1}$
 (2) $4.0 \times 10^{-4} \text{ atm s}^{-1}$
 (3) $5.0 \times 10^{-4} \text{ atm s}^{-1}$
 (4) $7.0 \times 10^{-4} \text{ atm s}^{-1}$
21. For $N_2 + 3H_2 \rightarrow 2NH_3 + 22 \text{ kcal}$, E_a (energy of activation) is 70 kcal. Hence, E_a of $2NH_3 \rightarrow N_2 + 3H_2$ is :-
 (1) 92 kcal (2) 70 kcal
 (3) - 70 kcal (4) - 92 kcal
22. A gaseous reaction, $2A(g) \rightarrow B(g) + 5C(g)$ shows increase in pressure from 80 mm to 100 mm in 5 minutes. The rate of disappearance of A is :-
 (1) 4 mm min^{-1} (2) 8 mm min^{-1}
 (3) 16 mm min^{-1} (4) 2 mm min^{-1}
23. On introducing a catalyst at 500K, the rate constant of a first order reaction increases 2.718 times. If the activation energy in the presence of a catalyst is 4.15 kJ mol^{-1} . Then what will be E_a in absence of catalyst (value of $e = 2.718$):-
 (1) 4.15 kJ (2) 2.08 kJ
 (3) 2.718 kJ (4) 8.3 kJ
24. For a first order reaction $A \rightarrow \text{products}$, the concentration of [A] is reduced from 2M to 0.125 M in one hour, the $t_{1/2}$ of this reaction (in min) is :-
 (1) 30 (2) 45 (3) 15 (4) None

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	2	1	1	1	3	2	1	1	2	1	4	1	4	1
Que.	16	17	18	19	20	21	22	23	24						
Ans.	1	4	4	2	2	1	4	4	3						

SOLUTION AND ITS COLLIGATIVE PROPERTIES

1. How many milli moles of sucrose should be dissolved in 500 g of water so as to get a solution which has a difference of 103.57°C between boiling point and freezing point of solution :-

$$(K_f = 1.86 \text{ K kg mol}^{-1}, K_b = 0.52 \text{ K kg mol}^{-1})$$

- (1) 500 milli moles (2) 900 milli moles
(3) 750 milli moles (4) 650 milli moles

2. A solution of x moles of sucrose in 100 g of water freezes at -0.2°C . Calculate the amount of ice separate out when it is cooled upto -0.25°C :-

- (1) 18 g (2) 20 g (3) 25 g (4) 23 g

3. Which of the following has been arranged in order of decreasing freezing point :-

- (1) $0.05 \text{ M KNO}_3 > 0.04 \text{ M BaCl}_2 > 0.140 \text{ M sucrose} > 0.075 \text{ M CuSO}_4$
(2) $0.04 \text{ M BaCl}_2 > 0.140 \text{ M sucrose} > 0.075 \text{ M CuSO}_4 > 0.05 \text{ M KNO}_3$
(3) $0.075 \text{ M CuSO}_4 > 0.140 \text{ M sucrose} > 0.04 \text{ M BaCl}_2 > 0.05 \text{ M KNO}_3$
(4) $0.075 \text{ M CuSO}_4 > 0.05 \text{ M KNO}_3 > 0.140 \text{ M sucrose} > 0.04 \text{ M BaCl}_2$

4. The Van't Hoff factor for BaCl_2 at 0.01M concentration is 1.98. The percentage dissociation of BaCl_2 at this concentration is -

- (1) 49 (2) 69 (3) 89 (4) 98

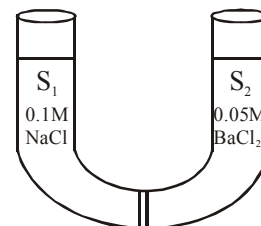
5. 6.8 g H_2O_2 is dissolved in 224 mL solution. This solution will be labelled as :-

- (1) 0.224 V (2) 20 V (3) 5 V (4) 10 V

6. The solubility of a gas in water at 300 K under a pressure of 100 atmospheres is $4 \times 10^{-3} \text{ kg L}^{-1}$. Therefore, the mass of the gas in kg dissolved in 250 mL of water under a pressure of 250 atm and 300 K is :-

- (1) 2.5×10^{-3} (2) 2.0×10^{-3}
(3) 1.25×10^{-3} (4) 5.0×10^{-3}

7. Two solutions S_1 and S_2 containing 0.1 M NaCl (aq) and 0.05 M BaCl_2 (aq) are separated by semipermeable membrane.



Which among the following statement(s) is/are correct ? (Assume complete dissociation of both the electrolytes)

- (1) S_1 and S_2 are isotonic
(2) S_1 is hypertonic while S_2 is hypotonic
(3) S_1 is hypotonic while S_2 is hypertonic
(4) All the above

8. The molarity of a solution made by mixing 50 mL of conc. H_2SO_4 (36 N) with 50 mL of water, is :

- (1) 36 M (2) 18 M (3) 9 M (4) 6M

9. An aqueous solution of urea containing 18 g urea in 1500 cm^3 of solution has a density of 1.052 g/cm^3 . If the molecular mass of urea is 60, then the molality of solution is :-

- (1) 0.2 (2) 0.192 (3) 0.064 (4) 1.2

10. Which solution will have the highest boiling point :-

- (1) 1% w/v glucose in water
(2) 1% w/v sucrose in water
(3) 1% w/v NaCl in water
(4) 1% w/v CaCl_2 in water

11. At 40°C , the vapour pressure (in torr) of methyl alcohol (A) and ethyl alcohol (B) solution is represented by $P = 120 X_A + 138$; where X_A is mole fraction of methyl alcohol. The value of $\lim_{X_A \rightarrow 0} \left(\frac{P_B^0}{X_B} \right)$ and $\lim_{X_B \rightarrow 0} \left(\frac{P_A^0}{X_A} \right)$ are :

$$\lim_{X_A \rightarrow 0} \left(\frac{P_B^0}{X_B} \right) \text{ and } \lim_{X_B \rightarrow 0} \left(\frac{P_A^0}{X_A} \right) \text{ are :}$$

- (1) 138, 258 (2) 258, 138
(3) 120, 138 (4) 138, 125

12. The vapour pressure of a solution of a non-volatile non-electrolyte (A) in a solvent (B) is 95 % of the vapour pressure of the solvent at the same temperature. If $M_B = 0.3 M_A$, where M_B and M_A are molecular weight of B and A respectively, the weight ratio of the solvent and solute are :-

(1) -0.17 (2) 5.7 (3) 0.2 (4) 4.0

13. When 20 g of naphthoic acid ($C_{11}H_8O_2$) is dissolved in 50g of benenze ($K_f = 1.72 \text{ K kg mol}^{-1}$), then freezing point depression of 2K is observed. The van't Haff factor (i) is :

(1) 0.5 (2) 1.0 (3) 2.0 (4) 3.0

14. If two substances A and B have $P_A^0 : P_B^0 = 1 : 2$ and have mole fraction in solution 1 : 2 then mole fraction of A in vapours

(1) 0.33 (2) 0.25 (3) 0.52 (4) 0.2

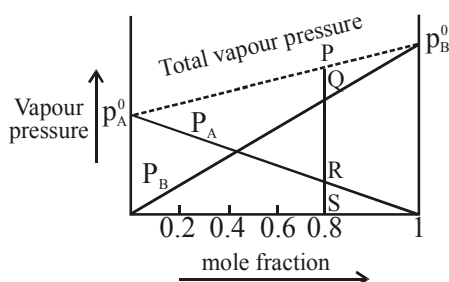
15. The mass of solute 'A' (mol mass = 40 g mol^{-1}) that should be added to 180 g of pure water in order to lower its vapour pressure to $4/5^{\text{th}}$ of its original value :-

(1) 187.5 g (2) 90 g (3) 150 g (4) 100 g

16. 150mL of C_2H_5OH (density = 0.78 g/ml) is diluted to one litre by adding water. Molality of the solution is -

(1) 1.54 (2) 11.7 (3) 2.99 (4) 29.9

17. Consider the following vapour pressure-composition graph, SP is equal to :-



(1) PQ + RS (2) QR + RS
(3) SR + SQ (4) PQ + QR

18. pH of a 0.1 M monobasic acid is measured to be 2. Its osmotic pressure at a given temperature T K is :-

(1) 0.1 RT (2) 0.11 RT (3) 1.1 RT (4) 0.01 RT

19. A solution containing 0.1 g of a non-volatile organic substance P(molecular mass 100) in 100g of benzene raises the boiling point of benzene by 0.2°C , while a solution containing 0.1 g of another non-volatile substance Q in the same amount of benzene raises the boiling point of benzene by 0.4°C . What is the ratio of molecular masses at P and Q ?

(1) 1 : 2 (2) 2 : 1 (3) 1 : 4 (4) 4 : 1

20. What is the osmotic pressure of the solution obtained by mixing 300 cm^3 of 0.6% (mass-volume) solution of urea with 300 cm^3 3.42% solution of sucrose at 20°C ?

(1) 5 atm (2) 5.2 atm (3) 2.4 atm (4) 4.5 atm

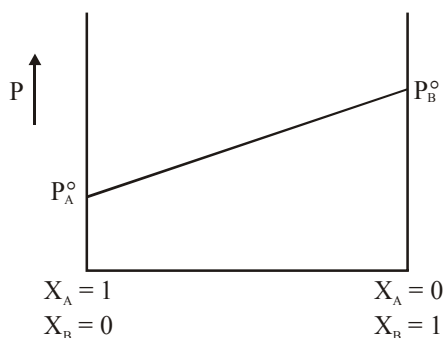
21. Two solutions of a substance (non-electrolyte) are mixed in the following manner 480 mL of 1.5M of first solution with 520 mL of 1.2 M of second solution. The molarity of final solution is:-

(1) 1.20 M (2) 1.50 M
(3) 1.344 M (4) 2.70 M

22. Equal amounts (mass) of a solute are dissolved in equal amounts of the solvents A and B. The relative lowering of vapour pressure for the solution A has twice that for the solution B. If M_A and M_B are the molar masses of solvent A and B respectively, then for dilute solution of A and B with solute :-

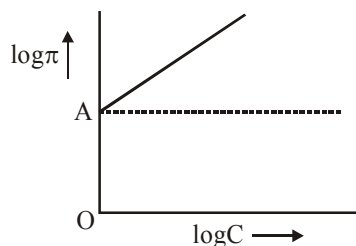
(1) $M_A = M_B$
(2) $M_A = \frac{M_B}{2}$
(3) $M_A = 4M_B$
(4) $M_A = 2M_B$

23. The following is a graph plotted between the vapour pressures of two volatile liquids against their respective mole fractions :-



- (1) When $X_A = 1$ then $P = P_A^0$
- (2) When $X_B = 1$ then $P < P_A^0$
- (3) When $X_A = 1$ then $P < P_B^0$
- (4) Both (1) and (3)

24. Variation of $\log \pi$ (atm) v/s $\log C$ (C = concentration of solute in g/L) is given



At 300K, for a solute of molar mass 300 g/mol, $OA = \log (x \times 10^{-2})$. What is the value of x ?

- (1) 8.21 (2) 0.0821 (3) 82.1 (4) 0.821

25. A 0.025 M solution of monobasic acid had a freezing point of -0.06°C . Calculate K_a for the acid. K_f for $\text{H}_2\text{O} = 1.86^\circ\text{C molality}^{-1}$. Assume molality equal to molarity.

- (1) 1.96×10^{-3} (2) 3.96×10^{-3}
(3) 2.96×10^{-3} (4) 5.8×10^{-3}

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	2	1	1	4	1	2	3	2	3	1	2	1	4	4
Que.	16	17	18	19	20	21	22	23	24	25					
Ans.	3	3	2	2	3	3	4	4	1	3					

ELECTROCHEMISTRY

- A 250 mL sample of a 0.2 M Cr^{3+} is electrolysed with a current of 96.5 amp; if the remaining concentration of Cr^{3+} ion is 0.1 M, the duration of electrolysis is : (Atomic wt. of Cr = 52) Assume volume of solution remains constant during electrolysis :-

(1) 75 sec (2) 150 sec
(3) 225 sec (4) 25 sec
- Electrolysis of hot aqueous solution of NaCl gives NaClO_4 , i.e., sodium perchlorate,
 $\text{NaCl} + 4\text{H}_2\text{O} \rightarrow \text{NaClO}_4 + 4\text{H}_2 \uparrow$
 How many faraday are required to obtain 1000 g of sodium perchlorate :-
 (1) 66 (2) 40.3 (3) 18.3 (4) 31.6
- Which of the following equation is incorrect ?

(1) $\Lambda_m^\circ(\text{KCl}) - \Lambda_m^\circ(\text{NaCl}) = \Lambda_m^\circ(\text{KBr}) - \Lambda_m^\circ(\text{NaBr})$
 (2) $\Lambda_m^\circ(\text{KBr}) - \Lambda_m^\circ(\text{NaBr}) = \Lambda_m^\circ(\text{KI}) - \Lambda_m^\circ(\text{NaI})$
 (3) $\Lambda_m^\circ(\text{NaBr}) - \Lambda_m^\circ(\text{NaCl}) = \Lambda_m^\circ(\text{KBr}) - \Lambda_m^\circ(\text{NaI})$
 (4) $\Lambda_m^\circ(\text{NaCl}) - \Lambda_m^\circ(\text{NaI}) = \Lambda_m^\circ(\text{KCl}) - \Lambda_m^\circ(\text{NaI})$
- Which of the following reaction is preferred at anode during the electrolysis of H_2SO_4 at higher concentration ?

(1) $2\text{H}_2\text{O}_{(l)} \longrightarrow \text{O}_{2(g)} + 4\text{H}^+ + 4\text{e}^-$
 (2) $2\text{SO}_{4(aq)}^{2-} \longrightarrow \text{S}_2\text{O}_{8(aq)}^{2-} + 2\text{e}^-$
 (3) Both (1) and (2)
 (4) None of the above
- Efficiency of the following cell is 84%.
 $\text{A(s)} + \text{B}^{2+}(\text{aq}) \rightleftharpoons \text{A}^{2+}(\text{aq}) + \text{B(s)}$
 $\Delta H^\circ = -285 \text{ kJ}$
 Then the standard electrode potential of the cell will be :-
 (1) 1.20 V (2) 2.40 V (3) 1.10 V (4) 1.24 V
- The pressure of hydrogen gas is increased from 1 atm to 100 atm. Keeping the H^+ (1M) constant, the voltage of the hydrogen half-cell at 25°C will be :-

(1) 0.059 V (2) 0.59 V
(3) 0.0259 V (4) - 0.0591 V
- For the cell reaction,
 $\text{Mg(s)} + 2\text{Ag}^+(\text{aq}) \rightleftharpoons \text{Mg}^{2+}(\text{aq}) + 2\text{Ag(s)}$,
 E°_{cell} is 3.17 V at 298 K. The value of E_{cell} , ΔG° and Q at Ag^+ and Mg^{2+} concentrations of 0.001 M and 0.02 M respectively are :-

(1) 3.04 V, - 605.8 kJ mol⁻¹, 20000
 (2) 3.04 V, 611.8 kJ mol⁻¹, 20000
 (3) 3.13 V, - 604 kJ mol⁻¹, 20
 (4) 3.04 V, - 611.8 kJ, 20000
- Consider the following four electrodes,
 $\text{P} = \text{Cu}^{2+} (0.0001 \text{ M}) / \text{Cu(s)}$
 $\text{Q} = \text{Cu}^{2+} (0.1 \text{ M}) / \text{Cu(s)}$
 $\text{R} = \text{Cu}^{2+} (0.01 \text{ M}) / \text{Cu(s)}$
 $\text{S} = \text{Cu}^{2+} (0.001 \text{ M}) / \text{Cu(s)}$
 If the standard reduction potential of $\text{Cu}^{2+} / \text{Cu}$ is 0.34 V, the reduction potential in volt of the above electrodes follow the order :-

(1) $\text{Q} > \text{R} > \text{S} > \text{P}$
 (2) $\text{P} > \text{S} > \text{R} > \text{Q}$
 (3) $\text{R} > \text{S} > \text{Q} > \text{P}$
 (4) $\text{P} > \text{Q} > \text{R} > \text{S}$
- Which is correct about fuel cell :-

(1) Cell continuously run as long as fuels are supplied
 (2) These are more efficient and free from pollution
 (3) These are used to provide electrical power and drinking water to astronauts in space programme
 (4) All of these
- The density of Cu is 8.94 g cm⁻³. The quantity of electricity needed to plate an area 10 cm × 10 cm to a thickness of 10⁻² cm using CuSO_4 solution would be

(1) 13586 C (2) 27172 C
(3) 40758 C (4) 20348 C

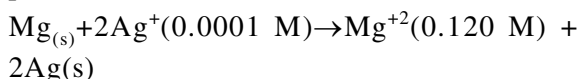
11. Salts of A (at wt. 7), B (at wt. 27) and C (at wt. 48) were electrolysed under identical conditions using the same quantity of electricity. It was found that when 2.1 g of A was deposited, the weights of B and C deposited were 2.7 g and 7.2 g. The valencies of A, B and C are respectively :-

(1) 3, 1 and 2 (2) 1, 3 and 2
(3) 3, 1 and 3 (4) 2, 3 and 2

12. The electrical resistance of a column of 0.05 mole/litre NaOH solution of diameter 1 cm and length 50 cm is 5.55×10^3 ohm. Calculate its molar conductivity :-

(1) $229.6 \text{ Scm}^2 \text{ mol}^{-1}$ (2) $119.5 \text{ Scm}^2 \text{ mol}^{-1}$
(3) $190.2 \text{ Scm}^2 \text{ mol}^{-1}$ (4) None of these

13. A cell in which the following reaction takes place :-



if $E_{\text{cell}}^\circ = 3.17$ volt then calculate E_{cell}

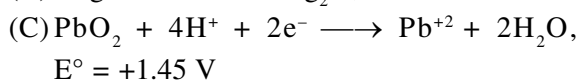
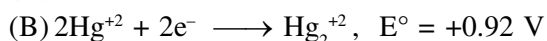
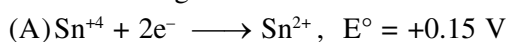
(1) 2.0 volt (2) 2.96 volt
(3) 3.50 volt (4) 3.17 volt

14. An electrochemical cell is set up as follows' $\text{Pt}(\text{H}_2 \text{ 1atm}) / 0.1 \text{ M HCl} || 0.1 \text{ M Acetic Acid} / (\text{H}_2 \text{ 1atm}) \text{ Pt}$.

E.M.F. of the cell will not be zero because :

- (1) The pH of 0.1 M HCl and 0.1 M acetic acid is not the same
(2) Acids used in the two compartments are different
(3) EMF of a cell depends on the molarities of acids used
(4) The temperature is constant

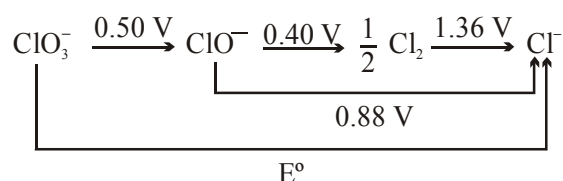
15. Standard electrode potential of some half cell reactions are given below -



for these which statement is correct -

- (1) Pb^{+2} is more powerful reducing agent than Sn^{+2}
(2) Sn^{+4} is more powerful oxidising agent than Pb^{+4}
(3) Sn^{+2} is more powerful reducing agent than Hg_2^{+2}
(4) Hg_2^{+2} is more powerful oxidising agent than Pb^{+4}

16. The E° in the given diagram is :-



(1) 0.5 (2) 0.63 (3) 0.7 (4) 0.8

17. If same quantity of electricity is passed through CuCl and CuSO_4 , the ratio of the weights of Cu deposited from CuSO_4 and CuCl is :-

(1) 2 : 1 (2) 1 : 2 (3) 1 : 1 (4) 4 : 1

18. The $k = 4.95 \times 10^{-5} \text{ S cm}^{-1}$ for a 0.00099 M solution. Calculate the degree of dissociation of acetic acid, if Λ_m^∞ for acetic acid is $400 \text{ S cm}^2 \text{ mol}^{-1}$:-

(1) 7 (2) 0.125 (3) 8 (4) 10

19. Value of Λ_m^∞ for SrCl_2 in water at 25° from the following data :

Conc. (mol/L)	0.25	1
$\Lambda_m (\Omega^{-1} \text{ cm}^2 \text{ mol}^{-1})$	260	250
(1) 270 (2) 260 (3) 250 (4) 255		

20. The standard reduction potentials E° of the following reactions are

	E° (Volt)
(i) $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$	1.51
(ii) $\text{Sn}^{4+} + 2\text{e}^- \rightarrow \text{Sn}^{2+}$	0.15
(iii) $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$	1.33
(iv) $\text{Ce}^{4+} + \text{e}^- \rightarrow \text{Ce}^{3+}$	1.61

The oxidising power of the various species decreases in the order :-

- (1) $\text{Ce}^{4+} > \text{Cr}_2\text{O}_7^{2-} > \text{Sn}^{4+} > \text{MnO}_4^-$
(2) $\text{Ce}^{4+} > \text{MnO}_4^- > \text{Cr}_2\text{O}_7^{2-} > \text{Sn}^{4+}$
(3) $\text{Cr}_2\text{O}_7^{2-} > \text{Sn}^{4+} > \text{Ce}^{4+} > \text{MnO}_4^-$
(4) $\text{MnO}_4^- > \text{Ce}^{4+} > \text{Sn}^{4+} > \text{Cr}_2\text{O}_7^{2-}$

21. The reduction potential of a half-cell consisting of a Pt electrode immersed in 1.5 M Fe^{2+} and 0.015 M Fe^{3+} solution at 25° C is
 ($E^\circ_{\text{Fe}^{3+}/\text{Fe}^{2+}} = 0.770 \text{ V}$)
 (1) 0.652 V (2) 0.88 V
 (3) 0.710 V (4) 0.850 V
22. The number of Faradays required to produce one mole of water from a hydrogen-oxygen fuel cell containing aqueous alkali as electrolyte is
 (1) 1 (2) 3 (3) 2 (4) 4
23. 4 mole of electrons were transferred from anode to cathode in an experiment on electrolysis of water. The total volume of the two dry gases (at STP) produced will be approximately (in L) :-
 (1) 22.4 (2) 44.8 (3) 67.2 (4) 89.4
24. The ionization constant of a weak electrolyte is 25×10^{-6} while the equivalent conductance of its 0.01 M solution is $19.6 \text{ S cm}^2 \text{ eq}^{-1}$. The equivalent conductance of the electrolyte at infinite dilution (in $\text{S cm}^2 \text{ eq}^{-1}$) will be :-
 (1) 250 (2) 196 (3) 392 (4) 384
25. Three moles of electrons are passed through three solutions in succession containing AgNO_3 , CuSO_4 and AuCl_3 , respectively. The molar ratio of amounts of cations reduced at cathode will be :-
 (1) 1 : 2 : 3 (2) 2 : 1 : 3
 (3) 3 : 2 : 1 (4) 6 : 3 : 2

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	1	4	2	4	4	4	1	4	2	2	1	2	1	3
Que.	16	17	18	19	20	21	22	23	24	25					
Ans.	2	2	2	1	2	1	3	3	3	4					

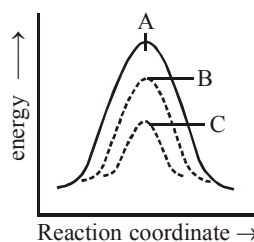
SURFACE CHEMISTRY

- Which of the following statements are correct ?
 - The smaller the gold number of lyophilic colloid, the larger will be its protective power.
 - Lyophilic sols, in contrast to lyophobic sols are easily coagulated on addition of small amounts of electrolytes.
 - Ferric chloride solution is used to stop bleeding from a fresh cut because it coagulates the blood.
 - The flocculation value of arsenious sulphide sol is independent of the anion of the coagulating electrolyte.
 - (1) a, b and c (2) a, c and d
 - (3) b, c and d (4) a, b and d
- The coagulation value in millimoles per litre of electrolytes used for the coagulation of As_2S_3 are as below :-

I. NaCl = 52	II. KCl = 51
III. $BaCl_2$ = 0.69	IV. $MgSO_4$ = 0.22

 The correct order of their flocculating power is :
 - (1) $I > II > III > IV$
 - (2) $I > II > III = IV$
 - (3) $IV > III > II > I$
 - (4) $IV = III > II > I$
- When a graph is plotted between $\log x/m$ and $\log P$, it is straight line with an angle 45° and intercept 0.3010 on y-axis. If initial pressure is 0.3 atm, what will be the amount of gas adsorbed per gm of adsorbent :-
 - (1) 0.4 (2) 0.6 (3) 0.8 (4) 0.1
- Silica gel, a colloidal dispersion of hydrated SiO_2 called is formed when dilute HCl is added to dilute solution of sodium silicate.
 - (1) Water glass (2) Water glass
 - (3) Quartz silica (4) Pearl glass
- Coagulation value of the electrolytes $AlCl_3$ and NaCl for As_2S_3 sol are 0.093 and 52 respectively. How many times $AlCl_3$ has greater coagulating power than NaCl :-
 - (1) 930 (2) 520
 - (3) 560 (4) 230
- Which one of the following statements is correct
 - (1) Brownian movement is more pronounced for smaller particles than for bigger ones
 - (2) Sols of metal sulphides are lyophilic
 - (3) Schulze-Hardy law states, the bigger the size of the ion, the greater is its coagulating power
 - (4) One would expect charcoal to adsorb chlorine more strongly than hydrogen sulphide
- Which of the following has minimum flocculation value for positively charged sol ?
 - (1) $Cl^\ominus$ (2) SO_4^{2-}
 - (3) PO_4^{3-} (4) $[Fe(CN)_6]^{4-}$
- Associated colloids :-
 - (1) Raise both the surface tension and viscosity of water
 - (2) Lower both the surface tension and the viscosity of water
 - (3) Lower the surface tension and raise the viscosity of water
 - (4) None of these
- Below critical micelle concentration (CMC) :-
 - (1) The surfactant molecules of ions undergo association to form clusters
 - (2) The viscosity of solution increase abruptly
 - (3) Substances like grease, fat etc. dissolve colloiddally
 - (4) Salt behave as normal, strong electrolyte

10. Equal volume of two sols of AgI, one obtained by adding AgNO_3 to slight excess of KI and another obtained by adding KI to slight excess of AgNO_3 are mixed together. Then :-
 (1) The two sols will stabilize each other
 (2) The sol particles will acquire more electric charge
 (3) The sols will coagulate each other mutually
 (4) A true solution will be obtained
11. On addition of one mL solution of 10% NaCl to 10mL gold sol in presence of 0.00015 g Gum arabic, coagulation is just prevented. The gold number of gum arabic is :
 (1) 15 (2) 1.5 (3) 0.15 (4) 0.025
12. Cleansing action of soap occurs because :-
 (1) Oil and grease can be absorbed into the hydrophobic centres of soap micelles and washed away
 (2) Oil and grease can be absorbed into hydrophilic centres of soap micelles and washed away
 (3) Oil and grease can be absorbed into both hydrophilic and hydrophobic centres but not washed away
 (4) None of these
13. When 1g charcoal is kept in SO_2 gas container, CO_2 gas container and H_2 gas container. The correct order of amount of gas adsorbed is :-
 (1) $\text{SO}_2 > \text{CO}_2 > \text{H}_2$ (2) $\text{H}_2 > \text{CO}_2 > \text{SO}_2$
 (3) $\text{CO}_2 > \text{H}_2 > \text{SO}_2$ (4) $\text{H}_2 = \text{CO}_2 > \text{SO}_2$
14. Which of the following is correct equation for freundlich adsorption isotherm :-
 (1) $\frac{x}{m} = KP^n$; $1 < \frac{1}{n}$
 (2) $\frac{x}{m} = KP^n$; $0 \leq \frac{1}{n} \leq 1$
 (3) $\log \frac{x}{m} = \log K + \frac{1}{n} \log p$; $0 \leq \frac{1}{n} \leq 1$
 (4) Both (2) & (3)
15. Lyophilic sols are known as protective colloids due to
 (1) They stabilize lyophobic sols
 (2) They have less Iron number
 (3) They have any metal number
 (4) None of above
16. The standard gold sol contains &to Measure protective power of lyophilic sol ?
 (1) 10 mL Au sol, 10 mL 10% NaCl solution
 (2) 10 mL NaCl sol, 1 mL 10% Au solution
 (3) 10 mL Au sol, 1 mL of 10% NaCl
 (4) 10 mL Au sol, x mg NaCl
17. Which of the following will have the highest coagulating power for $\text{Fe}(\text{OH})_3$ sol ?
 (1) PO_4^{-3} (2) SO_4^{-2}
 (3) Ca^{+2} (4) Al^{+3}
18. Blue colour of the sky is due to :-
 (1) Absorption of light by dust particles
 (2) Reflection of light by dust particles
 (3) Scattering of light by dust particles
 (4) None of these
19. Smoke precipitator works on the principle of
 (1) Centrifugation
 (2) Neutralization of charge on colloids
 (3) Absorption
 (4) Addition of electrolyte
20. In homogeneous catalytic reaction there are three paths A, B and C. Which one of the following indicates the relative ease with which the reaction can take place?
 (1) $A > B > C$
 (2) $C > B > A$
 (3) $B > C > A$
 (4) $A = B = C$



21. In multimolecular colloids sols, atoms or molecules are held by :-
 (1) Dative bonding (2) Vander waals force
 (3) Ionic bonding (4) Polar covalent bond
22. Air becomes dry in presence of silica gel due to
 (1) Colloidal solution formation
 (2) Catalytic properties
 (3) Adsorption
 (4) Absorption
23. Incorrect match regarding catalyst is :-
 (1) Ziggler Natta catalyst → Heterogeneous catalyst
 (2) Fe/Mo → Heterogenous catalyst/inhibitor
 (3) Pd/BaSO₄ Catalyst → Catalytic poison (BaSO₄)
 (4) Shape selective catalyst → ZSM-5
24. Tyndall effect and low colligative properties can be shown by :-
 (1) True solution
 (2) Colloidal solution
 (3) Hypertonic solution
 (4) Hypotonic solution
25. Micelle can not be formed by :-
 (1) CH₃(CH₂)₁₆ COO⁻ Na⁺
 (2) CH₃(CH₂)₁₁ SO₄⁻ Na⁺
 (3) CH₃(CH₂)₁₆ N⁺(CH₃)₃ Br⁻
 (4) CH₃COO⁻ K⁺
26. Which of the following is purification method of colloidal solution.
 (1) Electrodialysis (2) Peptization
 (3) Electrophoresis (4) Electro osmosis
27. A colloidal sol is formed by mixing AgNO₃ and KI in 2 : 1 molar ratio. This colloidal sol is to be coagulated by
 I. NaI II. MgSO₄ III. AlPO₄
 Molar ratio of these required to coagulate 1 mole of colloidal sol is :-
 (1) 1 : 1 : 1
 (2) 1 : 2 : 3
 (3) 3 : 2 : 1
 (4) 6 : 3 : 2
28. Which temperature is related to micelle formation ?
 (1) Critical temperature
 (2) Kraft temperature
 (3) Boyle's temperature
 (4) Inversion temperature
29. What the flocculation value of NaCl if 100 mL of arsenious sulphide sol requires 5 mL of 1 M NaCl for coagulation ?
 (1) 50 (2) 5 (3) 100 (4) 10
30. Choose the correct reasons for the stability of the lyophobic colloidal particles.
 (a) Preferential adsorption of ions on their surface from the solution.
 (b) Preferential adsorption of solvent on their surface from the solution.
 (c) Attraction between different particles having opposite charges on their surface.
 (d) Potential difference between the fixed layer and the diffused layer of opposite charges around the colloidal particles.
 (1) c, d (2) a, b
 (3) a, b, c (4) a, d

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	3	2	2	3	1	4	3	4	3	3	1	1	4	1
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	3	1	3	2	2	2	3	2	2	4	1	4	2	1	4